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Vol. 153, No. 20 May 18, 1944

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DO YOU DARE CUT INVENTORIES?

. . . here is a safe method that works!

Out of the maze of talk and conflicting statements regarding war contract cancellations and cutbacks—it seems reasonable to conclude that no large-scale production curtailment is expected until after the successful invasion of Europe is an accomplished fact. However, ordnance schedules are constantly being adjusted on account of changing needs and improved designs. This has resulted in recent cutbacks for many metal-working plants. Also, reserve stocks of certain war material have already reached a point where it has been found advisable to cancel further deliveries.

Due to this situation, many manufacturers may overnight be confronted with the task of disposing of steel overstocks. Too often these stocks are not easily converted to other production uses. A valued inventory can quickly become a white elephant.

We urge you to try to avoid this loss. Keep your inventory at a practical working level without excessive reserves. We believe this is entirely safe and practical today—and can be done without incurring undue risk to continuous production. There was a time when warehouse stocks were in rather bad shape and manufacturers, in self-defense, built up high steel inventories. But the WPB has seen the folly of each company carrying big inventories to meet all eventualities, and has permitted a reasonable build-up of general warehouse stocks, which serve everyone. Thus the overall tonnage of idle steel may be reduced, and the cutback and cancellation blows are cushioned.

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The
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Jobs for Everybody

JAMES Y. SCOTT, president of the National Machine Tool Builders' Association in addressing a meeting of this group last week, put some important thoughts into plain words.

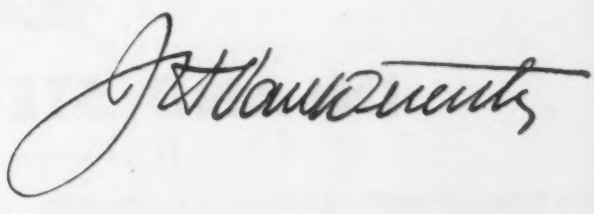
"I'm telling you," said Mr. Scott, "that after this war, cost cutting is going to be just about the biggest problem in the entire industrial field. You know that wages aren't going down. And you know too that if prices keep on going up, American industry won't be able to get the mass markets needed to sustain high level postwar employment. If American industry can't sustain high level postwar employment and today's workers are out of work just when the boys come back from the other side looking for jobs, who is going to step in to save the situation? You know the answer. Government will provide the jobs. Government will say: 'Obviously, industry can't take care of this situation. What we need in this country is more deficit spending.'"

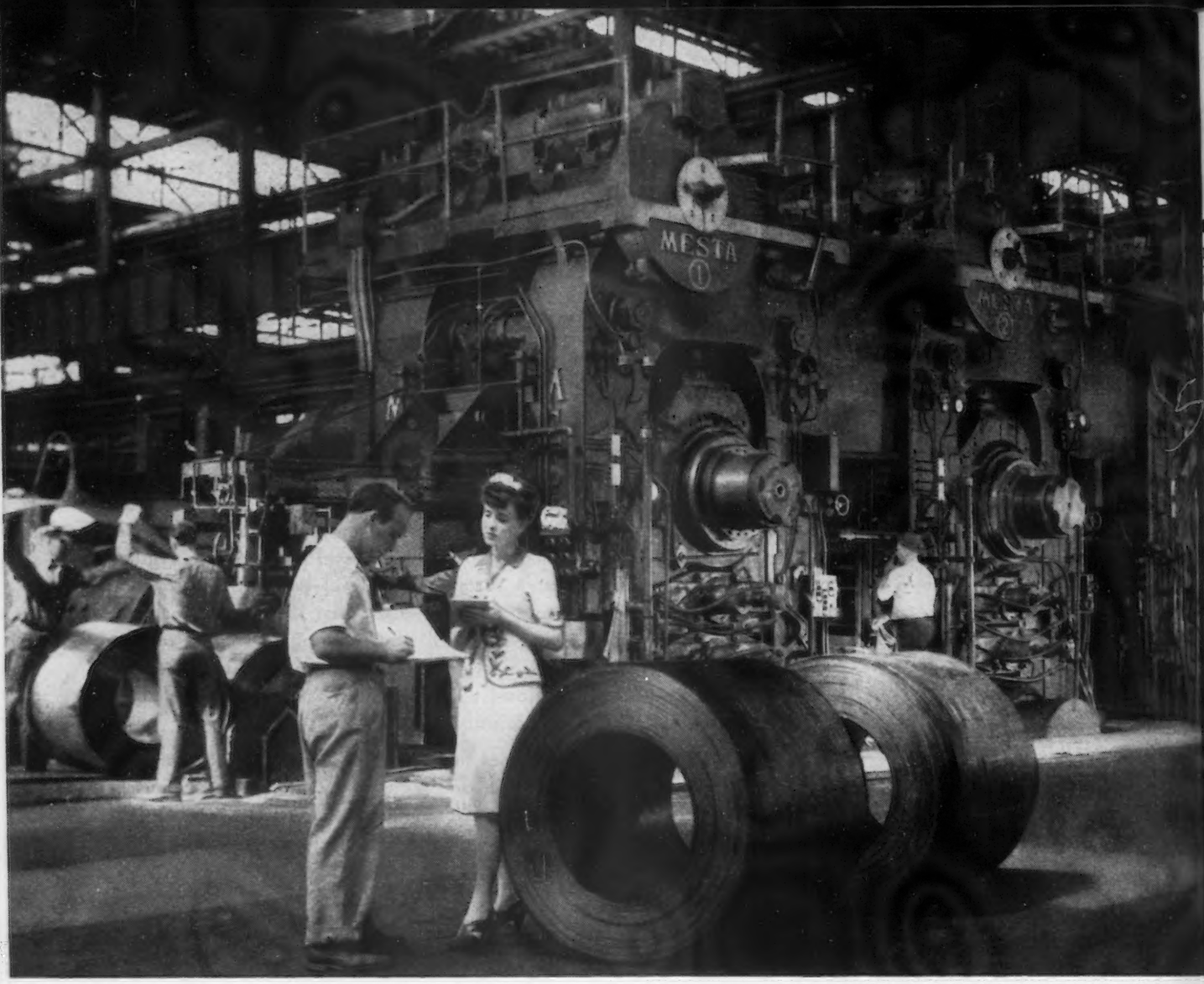
What Mr. Scott told the tool builders goes clear down the line and across the boards not merely in one industry but in all. The kind of prosperity that is financed by deficit spending is a fictitious one. In the nature of things it cannot last, since it eats itself up like the mythological worm.

The creation of enough wants and the means of satisfying them and thus of maintaining employment is a job that Government cannot undertake and that should not be wished upon it. The responsibility for doing it is multilateral and rests upon the shoulders of every man and woman having any part in productive enterprise. It is not something that we can assign to Uncle Sam, to the employer or to the labor leader.

More goods for more people means more jobs which is what we hope to have after the war. It means turning out more useful things than we have ever had before. It means turning them out faster, cheaper and better. It means stretching our dollars by the only means that dollars can be successfully made to go farther, namely cost reduction.

Everyone has a part to play in this big job of making things cost less which is another term for job building. The employer does it by providing better machinery, the worker by increasing his own efficiency, the labor leader by discouraging slow downs and by promoting harmony. Government too can play a big part in helping to reduce production costs in private enterprise by easing the tax burden that rests on all effort.





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The IRON AGE
MAY 18, 1944

NEWS FRONT

► From India as reverse lend-lease, American military forces received $35 million of which nearly half was represented by petroleum products. To date total aid from the British colony amounts to $149,512,000.

► Canadian manufacturers are negotiating with the Soviet Union for the sale of hydroelectric generating equipment for the rebuilding of the Dnieper Dam. Soviet purchases may exceed $25 million.

Russia has also awarded to Rust Furnace Co. a contract for design and critical materials for three continuous bloom heating furnaces.

► New military programs has stepped up machine tool demands so that tentative estimates of requirements for the last three quarters of the year now reach $400 million.

The War Department's heavy shell program will require 2000 new machines valued at about $16 million although when forging equipment, heat treating furnaces and other necessities are included, the dollar estimate may soar to $150 million.

► The new stainless steel air cargo plane has been put into full scale production by the Edward G. Budd Mfg. Co. For the first time on a considerable scale, welded stainless steel will be utilized instead of riveted aluminum alloy sheets.

The plane is a two engine transport 68 ft. long, with a wing spread of 100 ft., and is capable of transporting 10,400 lb. of cargo over a range of 650 miles.

► Attention is being given to the use of a glass spray on wire and narrow strip, during processing, to eliminate the need for acid cleaning. Glass is applied near the end of the rod rolling operation, and cracks off at about 400 deg., pulling the light surface oxides away at the same time.

► According to Franklin Johnson, American Exporter, there are in Hawaii many Japanese at large and at work, unlike the situation in California.

It is not unusual for the Japanese owner of a business to be in a concentration camp in the U. S., his son to be in the U. S. Army, and his wife or daughter running the store.

Twice, recently, purely Chinese firms gave luncheon parties and invited some of Muller & Phipps Japanese salesmen.

In Hawaii there is a tremendous inflation in services. One laundry recently offered $500 a month for a good laundry presser. And, Waikiki's well-known Wagon Wheel restaurant advertised recently that it would be "closed all day Sunday for the wedding of our head pantry girl to our chief cook. Open for business as usual Monday."

► Bell"s jet airplane will carry the designation P-59. Rumor is that it will be named the "Airarocket", but this is not quite true. At least four other manufacturers, other than Bell, are working on jet aircraft.

► According to the Berlin radio, the RAF is employing a small radio set suspended from a balloon. This, when dropped over the target, guides the bombers by emitting a direction-finding note.

► The Northrup P-61 "Black Widow", the new U. S. secret fighter, is to be powered by two 2000 plus hp. P. & W. double Wasp motors, and a Swedish report says it is to be fitted with air-borne radar equipment for locating enemy airplanes.

► 16-2 stainless steel, although known for many years, has only recently been used in this country. Aircraft manufacturers are now learning that weight can be saved by using this type as a substitute for 18-8 when heat treated to 175,000 lb. per sq. in. tensile strength.

Although corrosion resistance is inferior to that of 18-8, the short life of the modern aircraft in wartime service has accelerated its approval by the armed forces as a substitute for more corrosion resistant steels.

► For the duration and six months thereafter, Western Pacific and Southern Pacific railroads have volunteered to carry finished steel from Geneva, Utah, to San Francisco Bay for $8 per ton. However, Utah industrialists still feel that this rate is too high and in order to assure the Geneva mill's competitive future a rate to tidewater must not be over $6.

Hyper Milling vs. Fly Cutter Milling

. . . Among the advantages cited by the author in favor of single-point fly cutter milling over multi-tooth face mills with negative rake angles are the lower power requirements, reduced cost and ease in maintenance. A cutter body is described in which the fly cutter can be mounted in one of several slots at various negative helix or axial rake angles to suit the particular operating conditions.

By GAYLORD G. THOMPSON
Manufacturing Engineer
Joshua Hendy Iron Works, Sunnyvale, Cal.

o o o

IN the early part of November, 1943, the president of a prominent carbide tool manufacturing concern gave a lecture before a group of engineers at the Joshua Hendy Iron Works, Sunnyvale, Cal. This lecture was supplemented by moving pictures showing a hyper milling cutter machining steel at the rate of 3500 ft. per min. and better. A peculiar fact in connection with this remarkable performance was that when the peripheral speed came into the range of 5000 to 6000 ft. per min., and it became necessary to sharpen the hyper milling cutter—now get a load of this—the cutter was sharpened by grinding away the *body of the cutter from around the carbide tips.* (In this special cutter, the carbide tips were brazed directly to the cutter body.) If it were not for the scientific correctness of this grinding procedure, its very essence of goofiness would create gobs of humor for tool engineers.

When some new outstanding performance of carbide tools is revealed to the trade, tool engineers, mechanics and other personnel in the factory and shop become more convinced that carbide tools are as unpredictable as a chicken on the roadside in front of your speeding car. A small insignificant clearance angle, positive or negative, may mean the difference between total failure of the tool or its complete success.

Machine tool designers and manufacturers have been forced into exasperating pursuit of the fast traveling manufacturers of carbide metal cutting tools. Machine tools that were built in the area of high speed steels just did not have the power and speed to give carbide tools a good workout. Too slow a speed is definitely detrimental to carbide tools.

Manufacturers of engine lathes, turret lathes, boring mills and planers have done a good job in designing machines that put them into a neck and neck race with carbide tools. Milling machine manufacturers, however, have had the worst handicap to overcome. While their products, which also include horizontal boring and milling machines, were built to operate at speeds as high as 400 ft. per min., involving considerable r.p.m. ordinarliy fast enough for efficient production performance with carbide tools, now they are confronted with this new steel devouring glutton of the milling cutter world—the hyper milling cutter. Just like chasing a kangaroo—they catch up to it only to have the "bloomin' thing" make a big jump ahead of them again. There are, however, many milling machines and horizontal boring mills of late design in use throughout the country that can operate hyper milling cutters very economically because of being able to attain peripheral speeds in the range most suitable to carbide tools.

The Joshua Hendy Iron Works is one plant in which considerable experimenting has been done and experience obtained with hyper milling cutters. This work brings a new slant to economic production with milling cutters. This new slant involves the question as to which is the more economical hyper milling cutter to use—the multi-tooth type with inserted carbide tipped blades or the single-toothed carbide tipped blade used as a fly cutter.

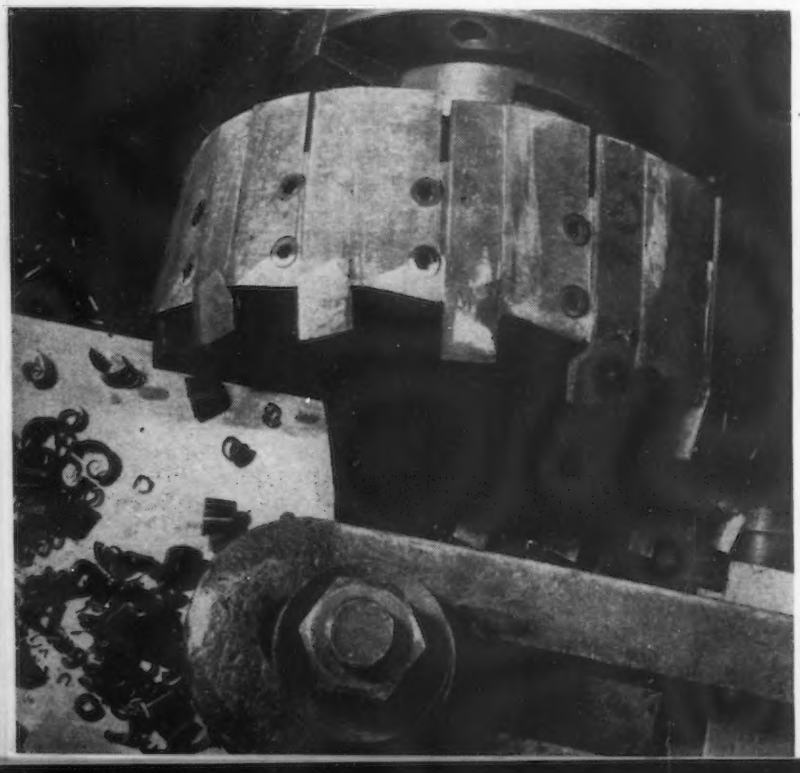

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FIG. 1—View from above of a typical multi-tooth hyper milling cutter mounted in a horizontal boring mill. Note the clean chips.

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Example Cited

Fig. 1 is a bird's-eye view of a conventional multi-tooth hyper milling cutter in action on the face of a steel connecting rod for a reciprocating steam engine. A drawing of the cutter head is shown in Fig. 2. The negative helix angle of the slots is equivalent to a 10-deg. negative back

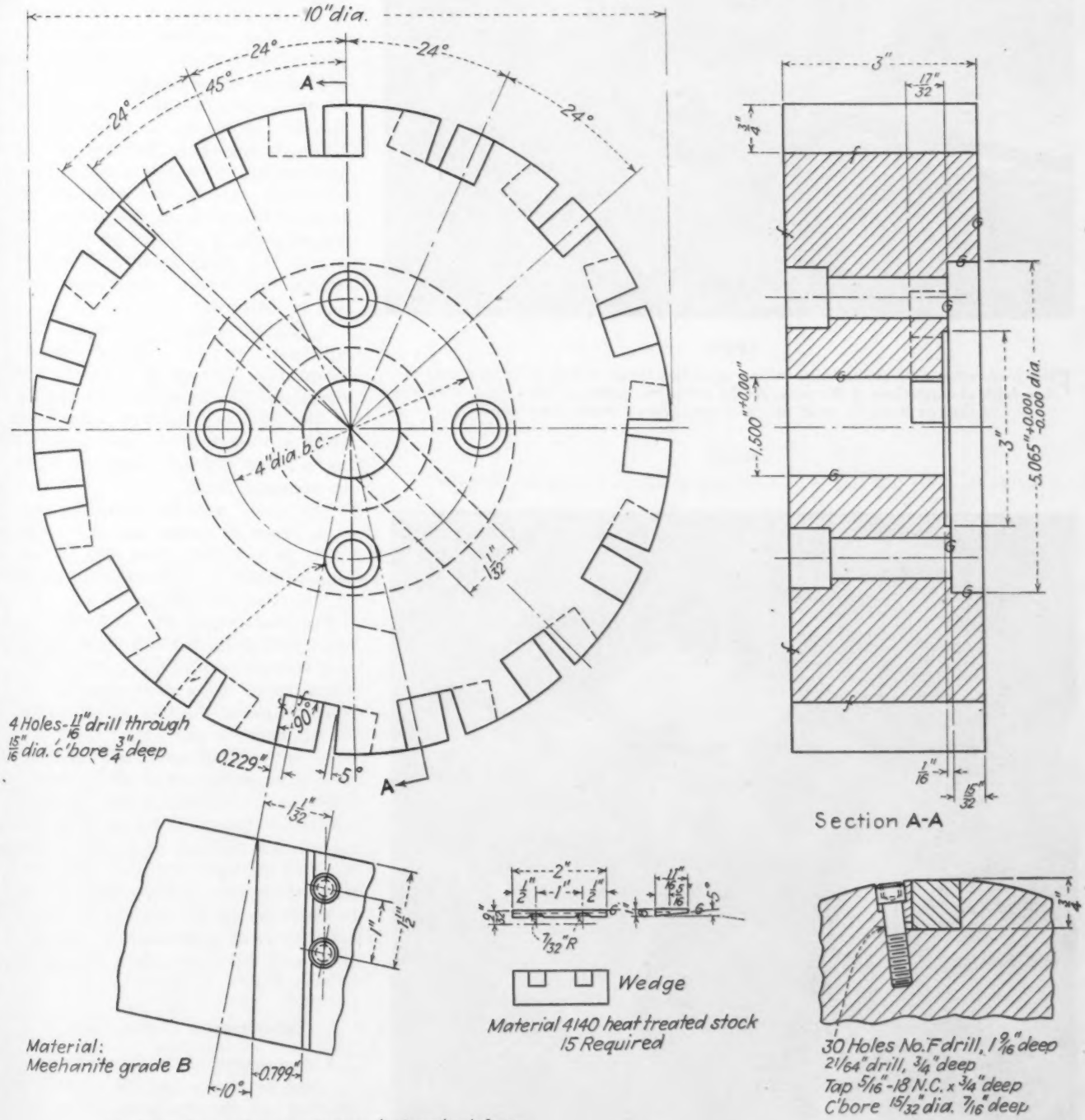
rake angle ground on a tool placed in a straight slot. Since the machine in this picture was comparatively light for the rugged action imposed by the hyper cutter, the highest cutting speed attainable was 690 ft. per min. Nevertheless, this operation was completed in 1.8 min., whereas 30 min. was consumed when high speed steel cutters were used.

This same hyper milling cutter was placed on another heavier machine with greater power, permitting a spindle speed of 330 r.p.m., corresponding to a speed of 864 ft. per min. Depth of cut was up to ½ in. at a feed of 9 in. per min., equaling 864 ft. per min. producing an operation in 4 min. that formerly took 2 hr. with high speed steel cutters. However, this speed could not be maintained on steady production because of overburdening the machine and motor. The speed was lowered to 289 r.p.m., maximum depth of cut to ¼ in. and feed to 3.1 in. per min. This rearrangement provided a peripheral speed of 730 ft. per min.—well up in the range of efficient carbide tool performance.

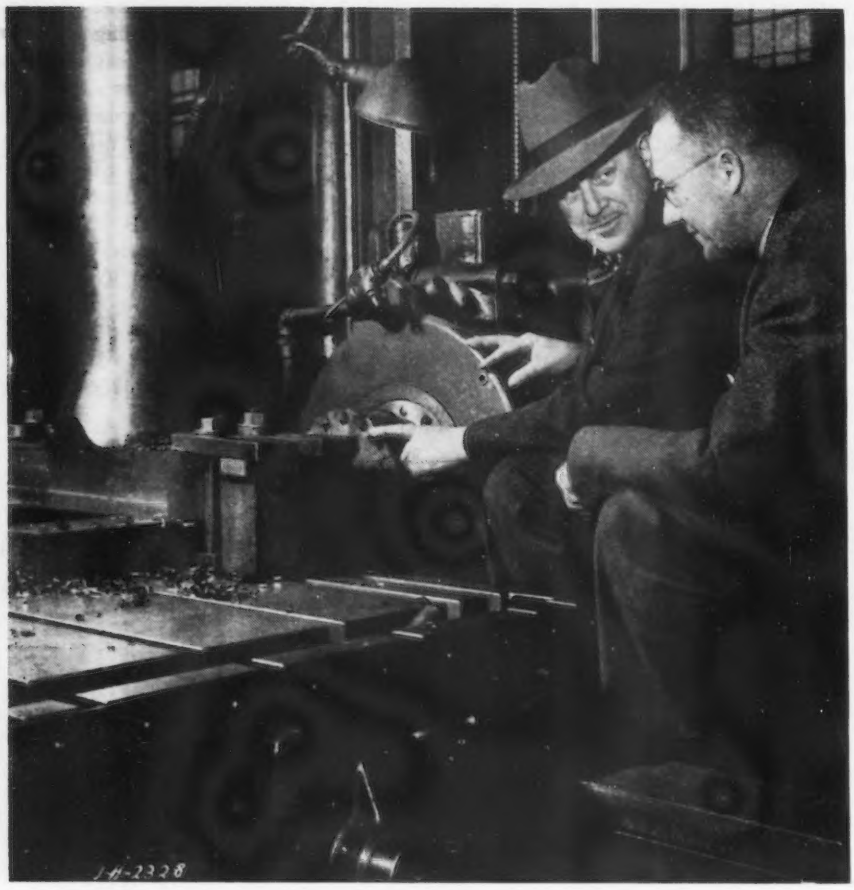
Fig. 3 shows a more distant photograph of the hyper milling cutter in order to reveal the glossy finish as produced by the cutter on one face of the rod. The finish produced was excellent—a characteristic of all hyper milling cutters. Oftentimes questions have been asked as to whether the work was ground.

Now then, we come to the subject of hyper fly cutter milling. This type of milling was first adopted at the Hendy Iron Works when the 3 in. face of a frame similar to that of a door casing had to be milled. This facing

Fig. 2—Details of the cutter shown in Fig. 1. Body is Meehanite. Blades are set at 10 deg. negative helix angle, 0 deg. radial rake.



Machine all over allowing grinding stock on back face and pilot holes. Preheat to 1100°F.-raise to 1575°F. to 1600°F., draw at 730° to 750°F., finish grind back face and pilot holes

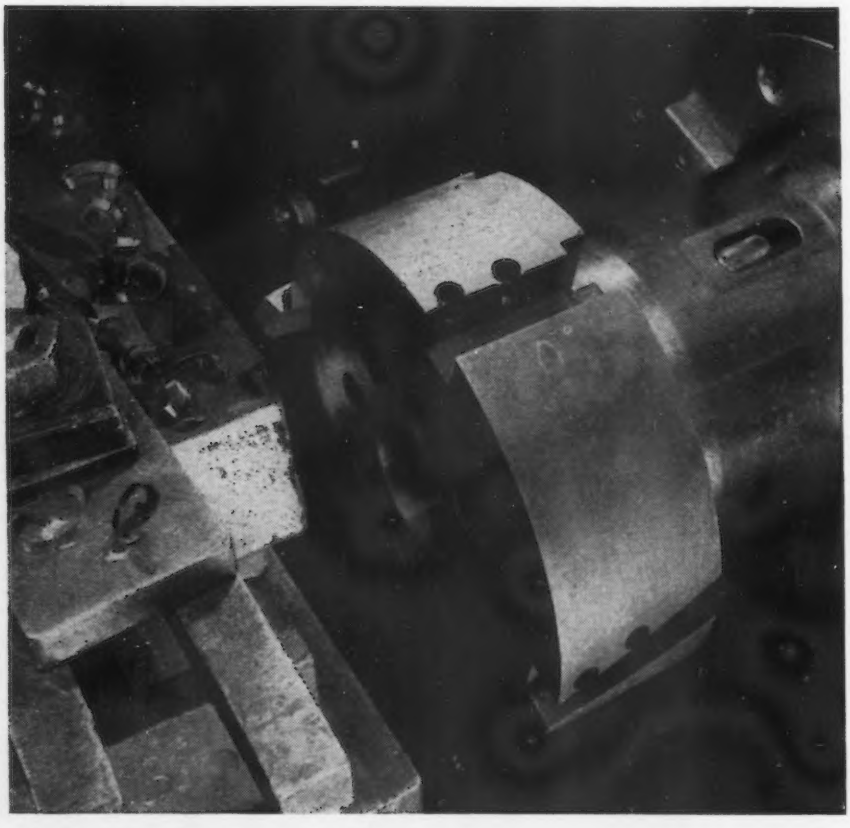


ABOVE

FIG. 3—Another view of the hyper milling operation shown in Fig. 1. It illustrates the fine finish characteristic of this work. At the left is the author of this article. With him is George Bowman, chief tool engineer, Joshua Hendy Iron Works.

BELOW

Fig. 4—Fly cutter tool used in a special milling body in a horizontal boring mill.



operation necessitated extending the 6 in. diameter spindle of the horizontal boring mill out about 4 ft. from the front main bearing. The material to be milled was of fabricated boiler plate steel and naturally, when a small H.S.S. milling cutter was attached to the end of the spindle for this milling operation, the chattering and vibration due to the extreme extension of the spindle made this operation impractical.

Fly Cutter Application

An experimental hyper fly cutter head was made up as shown in position in the horizontal boring mill, Fig. 4. This head has four slots to hold a ¾ in. square shanked carbide tipped tool in one of four positions. The slots were cut in the head at 0, 10, 20 and 30 deg. negative helix angles as shown in the drawing of the head in Fig. 5. The reason for providing for different angles is because of the peculiarities of carbide tools. Oftentimes, the carbide tool will not perform satisfactorily in one angle position whereas it will "go to town" at one of the other angles. Especially is this true where intermittent cutting is involved.

In this particular instance, the face milling of the "door frames" was accomplished without any chatter or vibration. The fly cutter tool was set in the 10 deg. negative angle slot which proved to be the best performing position and one which produced an excellent finish.

The speed used in operating this 9 in. hyper fly cutter was 250 r.p.m. —590 ft. per min.; feed, 2½ in. per min. or 0.010 in. per rev., and depth of cut, 0.005 to 0.250 in.

The photograph, Fig. 6, shows another view of the hyper fly cutter used in a vertical position for milling horizontal faces. This photo gives an excellent view of the tool as set in the 10 deg. negative angle slot. The heavy chips in the foreground were produced in the roughing cut while the finer chips were produced in the finishing cut which happened to be 0.008 in. deep in this instance. Note the smooth finish of the work, the gloss of which makes it appear that a coating of oil or water lay on the surface. The fact is however, all hyper milling, whether with multi blade or single fly cutter, is done *dry*.

Experimental Cutter Tool

A photograph of the hyper fly cutter tool is shown in Fig. 7 and a drawing of the same is shown in Fig. 8. Incidentally, in order to avoid the possibility of the fly cutter tool being clamped in the wrong slot, the

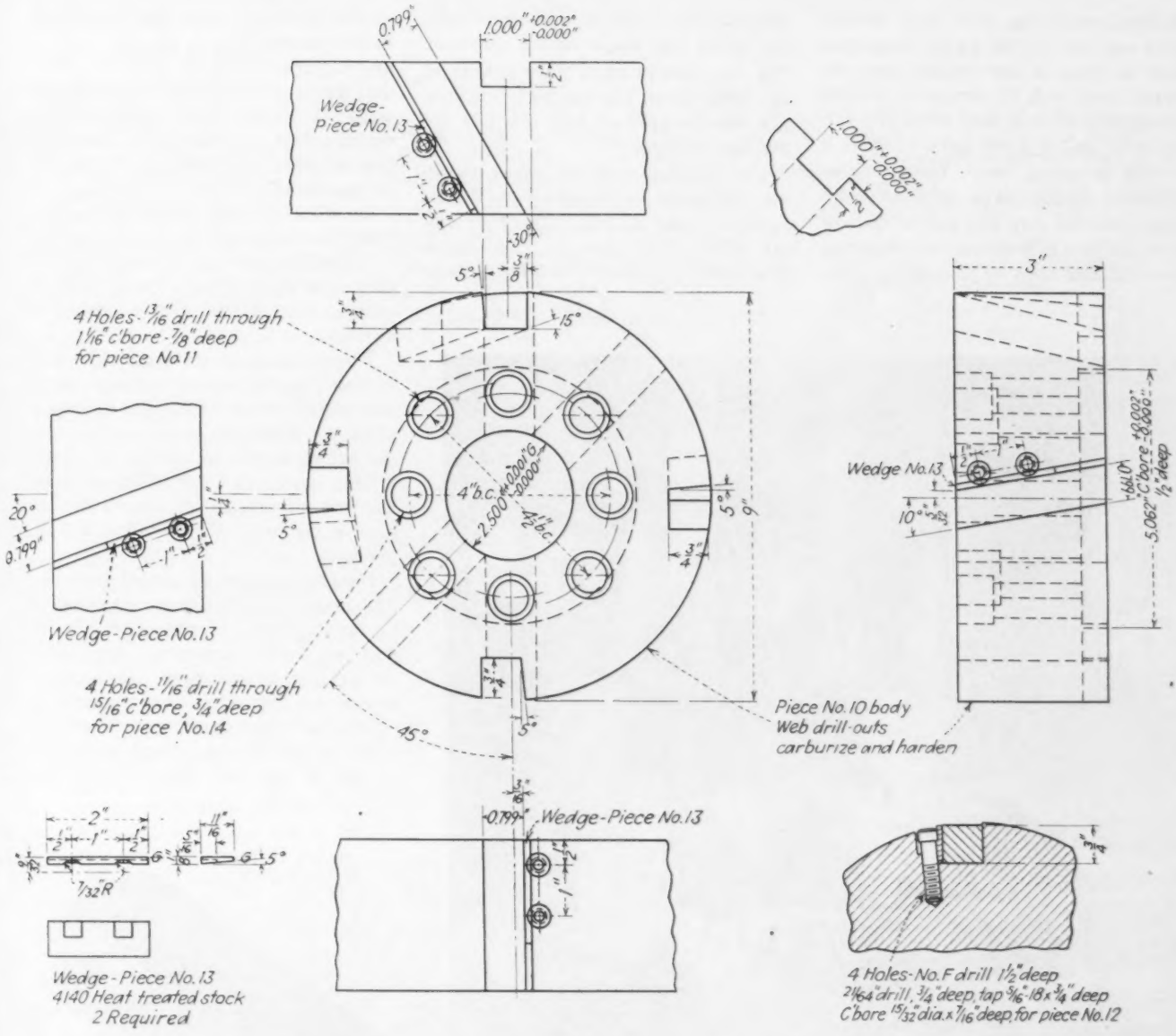

Wedge-Piece No. 13
4 Holes-13/16" drill through 1 1/16" c'bore-7/8" deep for piece No. 11
Wedge-Piece No. 13
4 Holes-1 1/16" drill through 15/16" c'bore, 3/4" deep for piece No. 14
Piece No. 10 body
Web drill-outs
carburize and harden
Wedge No. 13
4 Holes-No. F drill 1 1/2" deep
2 11/64" drill, 3/4" deep, tap 5/16"-18 x 3/4" deep
C'bore 15/32" dia. x 7/16" deep for piece No. 12
Wedge-Piece No. 13
4140 Heat treated stock
2 Required

Fig. 5—Details of the cutter body pictured in Fig. 4. The single cutter can be held at either 0, 10, 20 or 30 deg. negative helix angle.

angle setup for which the tool is designed is stamped on the top face of the tool shank, together with the tool number by which it is identified in the tool crib. The tool in the photograph shows the tool number as X-236 while the number 10 signifies the slot angle in the head for which the tool is ground—namely, 10 deg. As a matter of information, the tool used in the hyper fly cutter was Kennametal Grade KM, style No. 11-T-50, a standard tool ground to modifications as shown in the drawing in Fig. 8.

A very gratifying result obtained by the hyper fly cutting operations with cutter positioned as shown in Figs. 4 and 6, representing two different setups on the same weldment, was the fact that the job which formerly took an allowance of 140 hr. to complete was whittled down to an actual consumption of 49 hr.—a reduction of almost 66 per cent in machining time. This saving of 91 hr. can best be appreciated when it is known that it involves an $85,000 machine whose overhead charges plus the labor of two mechanics present a sizeable figure.

A general foreman of another department, upon witnessing the performance of the hyper fly cutter remarked, "Say—I've been using hyper milling cutters on a job in my department that should be made-to-order for this fly cutter head. You see, I got only one carbide cutter head for the present until others are made. I use it for a couple of hours and then I got to wait 6 or 8 hr. for it to get sharpened. In the meantime I use high speed steel milling cutters which takes about ten times as long to do the job. How about using a hyper fly cutter on the job?"

This foreman, Bill, got his hyper fly cutter with all the trimmings as explained in the foregoing paragraphs. The job setup was solid and close to the main bearing of the machine from which the spindle extended—a setup that is near to perfection for economical performance of carbine tools on interrupted cuts.

The cutter was started at 250 r.p.m. at 1½ in. feed per min. with from 1/16 to 5/16 in. depth of cut. This speed was gradually stepped up to 380 r.p.m. and the feed to 9 in. per min., but Bill's enthusiasm for speed was toned down by the superintendent of maintenance to 298 r.p.m. with 3.2 in. feed per min., which is equivalent to approximately 0.010 in. feed per rev. The former speeds and feeds were too much for the machine and motor.

Practical Viewpoint

A few hours later Bill remarked: "You know, Thompson—I was never sold on them damn carbide tools but when I seen the way that hyper milling cutter and that hyper fly cutter

worked—well, I'm sold. But listen—that one tool in the hyper head lasts just as long, if not longer, than the hyper head with 15 cutters in it—and the beauty of it is that when the cutter gets dull I don't have to send it to the grinding room for precision grinding which takes up 6 to 8 hr. time. All the guy has got to do now is to put in a new sharp tool when one gets dull and keep on producing. Yes, sir!—that hyper fly cutter setup dulls only *one* tool at a time while the other dulls 15! Think what that means in time saving and tool expense!"

When the speed for the multi-toothed hyper milling cutter was set at 298 r.p.m. the feed was set at 6.3 in. per min. with depth of cuts not to exceed ⅜ in. The limitations were found necessary in order to avoid the possibility of machine breakdown and motor trouble because of excessive speed and constant strains. Now then, when the fly cutter type of hyper milling cutter was placed on the operation the only change required was that of the feed, which was reduced to 3.2 in. per min. because of only one tool doing the cutting.

The question might be asked, "Why was not more feed used on the multi-toothed hyper milling cutter? If you can take 3.2 in. per min. feed on a single tool, you should be able to take 45 in. per min. on a cutter with 15 blades."

Speed Limitations

This reasoning is logical and partly answered in the opening paragraphs. The limitations are due to the lack of capacity of the machine to operate at high speeds required by carbide tools—especially when from one to eight tools may be cutting simultaneously. Two expensive breakdowns were experienced more from unusually high speeds than from strain of pulling cuts. Bearings froze in the geared heads, stripping gears and bending shafts to such an extent that weeks of valuable production time were lost by the two machines. Not wanting this to occur again, the maintenance superintendent set limitations on speeds and feeds.

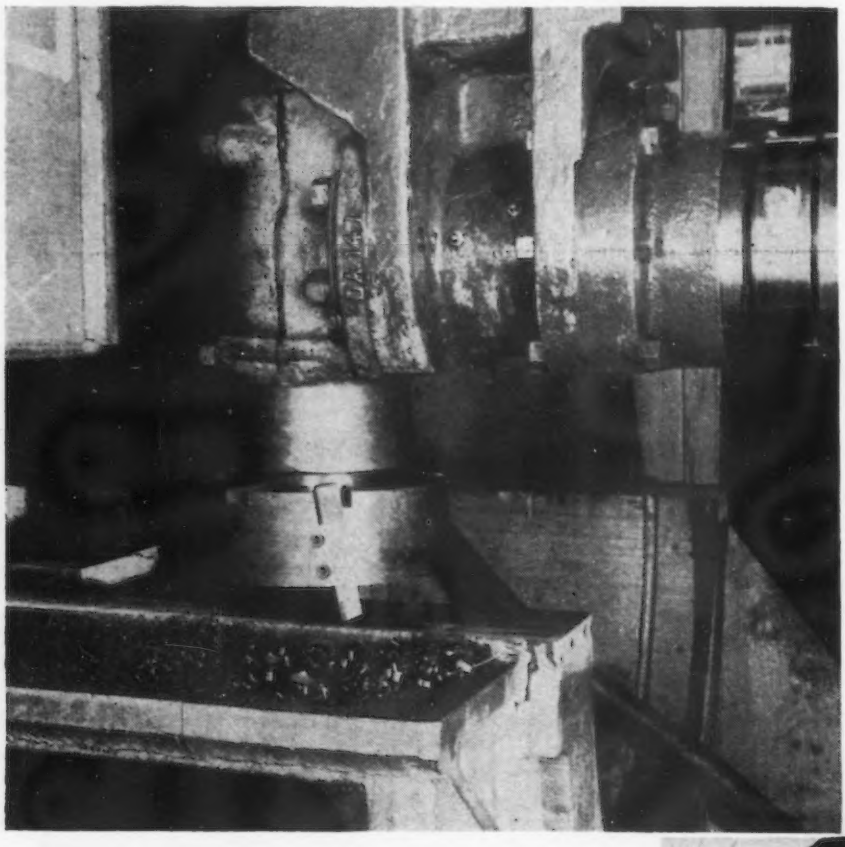
In spite of these limitations, however, the speeds are ample for carbide tool performance and the production surpasses that of high speed steels to such an extent that caution could be afforded.

The battle between the multi-toothed carbide tipped hyper milling cutter and the single-toothed hyper fly cutter could no doubt be controversial. In the examples quoted above, the hyper milling cutter at 6.3 in. feed per min. has the advantage of almost two to one on the hyper fly cutter at 3.2 in. per min.

But, let us take an actual example. The multi-toothed hyper cutter *never* exceeded a steady production run of 8 hr. with one sharpening. As a matter of fact the average life between grinds was 2 to 6 hr. And remember, in this case there are 15 tools involved.

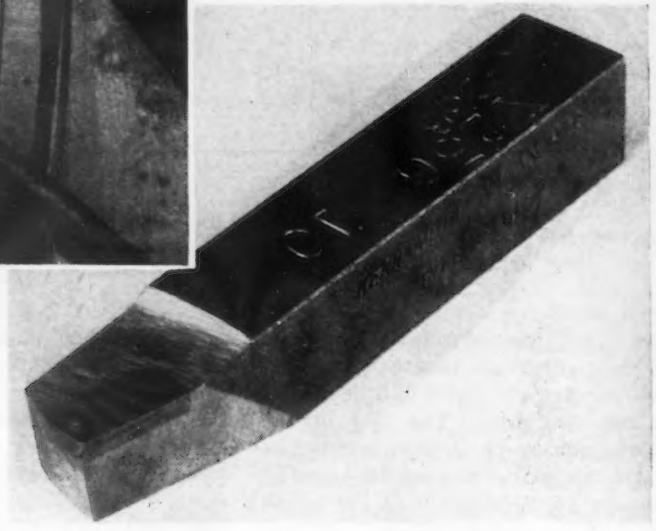
The hyper fly cutter tool as shown in the photograph, Fig. 7, and the drawing, Fig. 8, made a record run of constant performance starting with the day shift at 4.00 p.m. and continued throughout the 8 hr. of swing shift and finally had to be taken out for sharpening at 2.00 a.m. by the graveyard shift—a run of solid production for 10 hr. And only *one* tool had to be sharpened! Not 15! Something to think about there!

One fact that might explain the superiority of the single fly cutter tool over that of the multi-tooled cutter is in the grinding—and remember—this



ABOVE

FIG. 6—This view of the hyper fly cutter on a vertical adaptor clearly shows the 10 deg. negative helix angle in which the single point tool is mounted.



RIGHT

FIG. 7—A standard carbide lathe tool ground to form a hyper fly cutter blade. Note the marking on the tool shank.

is by far the most critical moment in the life of a carbide tool. A standard carbide tool set at 10 deg. negative helix angle in the cutter head would have a front clearance of 10 deg. plus the usual 5 or 6 deg. on the standard tool, making a total of 15 to 16 deg. positive clearance which is very excessive. Since only 4 deg. of front clearance is actually needed at the point of the tool and the tool is set at 10 deg. negative, this means that a front negative rake of 6 deg. must be ground on the tool point to reduce the excessive clearance caused by the position of the tool in the 10 deg. negative slot in the cutter head. See *A* in Fig. 8 and compare with the appearance of the point of the tool as shown in the photograph in Fig. 7.

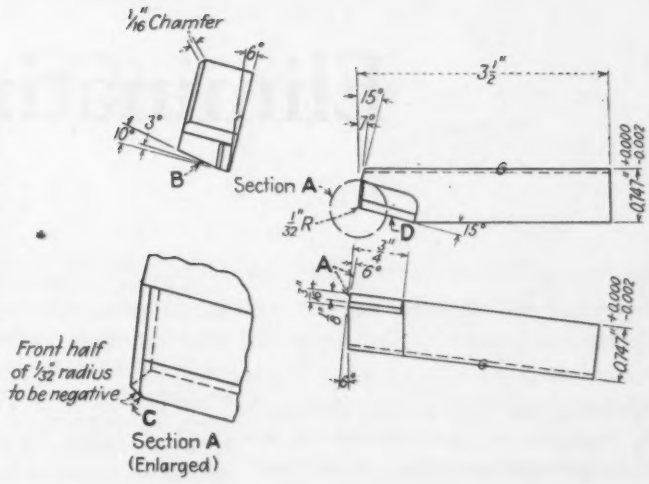


FIG. 8—Details of the hyper fly cutter bit shown in Fig. 7. Because of the angle at which the tool is mounted, the front clearance angle is 6 deg. negative with respect to the top face.

Blending of Angles

Now is where we come to the critical phase in the grinding of the tool that makes it superior in performance to the tools in the multi-cutter head. This critical moment in the grinding operation is the *blending of the negative rake at the front of the tool, into the positive clearance at the side of the tool.* If, in grinding the small radius at the point of the tool, the 6 deg. negative rake is carried around the tool point too far, a negative clearance is created on the side of the tool where positive clearance is required as shown at *B* in Fig 8.

In the machine grinding of the multi-tool hyper cutter, the negative front rake and the side cutting edge angle can be ground accurately, but when it comes to blending the negative front clearance of 6 deg. around the point and gradually coming into a positive clearance on the cutting side of the tool—it just can't be done on the present type of milling cutter grinders. Because of this, the machine-ground hyper milling cutter tools are forced to get along without the desired support under the small radius on the very point of the tool as at *C* in Fig. 8.

The hyper fly cutter tool is more fortunate in this respect in that there is a machine commercially available for grinding each cutter individually to exact duplicate form with blended positive and negative relief angles around the nose of the tool, thus giving the weakest part of the tool maximum support. This machine is the Bura-way grinder* made by the James Donaldson Co., New York. In this unit provision is made for the angular setting of the tool in a vertical plane, in a heavy, but freely moving tool holder which can be slid by hand upon the surface of a pivoted table in front of the wheel. The angular setting of this sine bar table, so called because of the method used to set angles precisely, determines the side clearance or relief angle of the tool since it governs the tilt of the tool shank when presented sidewise to the wheel. On the other hand, the combined angular setting of tool holder and table determines the front relief angle of the tool. Duplication of the form of the tool is obtained by a cam on the base of the moveable tool holder that is rocked or oscillated against a flat cam bar below and behind the grinding wheel face. When used to grind lathe tools the machine generates a relief surface around the nose of a tool that is constant in the direction of feed, thus giving uniform wear around the cutting edge.

For grinding the tool shown in Fig. 8, the sine bar table of the Bura-way would be set at 3 deg., providing the positive side relief at the side cutting edge or chamfer *D*. In its independent holder, the tool would be tilted with its shank upward at an angle of 9 deg. (negative) so that when the tool is presented straight onto the face of the cup wheel an effective relief angle of 6 deg. negative 9—3 deg. is obtained. When the tool holder is slid around to present the side cutting edge *D* to the wheel face, this negative angle is blended around the nose into a 3 deg. positive relief angle governed by the sine bar table setting.

** For a description of this unit, see "A New Conception in Tool Grinding," THE IRON AGE, May 21, 1942.*

Improved Explosive Rivet

AN improved explosive rivet that fits itself to the hole has been developed by the explosive department of E. I. du Pont de Nemours & Co. Although its present application is to military aircraft, eventually it is expected to have many postwar uses in the fabrication of such products as radios, refrigerators, automobiles and buses.

The original rivet, introduced two years ago, was expanded at the end of the shank to lock it in place. Improvement of the rivet, made of aluminum alloy, was accomplished by embodying in it a small auxiliary explosive cavity and modifying slightly the explosive charge. The auxiliary cavity extends from the main chamber in the shank toward the head of the rivet. Detonation of the charge expands the entire shank.

This leeway makes possible more rapid insertion of the rivets. After insertion, the new rivet, like the original, may be expanded by one man at the rate of 10 to 20 per min., as contrasted with 2 to 4 per min. for most "blind" rivets. The new rivets will be available in diameters of 5/32 and 3/16 in. in the modified brazier types, and perhaps in other types.

The new explosive used has the same noncorrosive, nontoxic and high stability properties. The explosive charge is usually detonated with an electric riveting iron which fires the charge in the cavity when heat is applied to the head.

Eliminating Cracking in H

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STEELS for drop forging dies are supplied by steel works in a number of qualities, in an annealed or heat treated condition. The strength of the steel influences the performance of the dies very greatly. However, certain economic considerations, such as machinability, limit the strength of the material which is supplied to 90,000 lb. per sq. in., and usually a lower tensile strength of some 70,000 lb. per sq. in. is used.

For very large dies with a deep relief this strength is generally adequate. In flat dies, much higher strengths are desirable to prevent the early wear of the tool, particularly when they are used for forging hard materials. It is customary to buy die steels also for heavier tools in the annealed condition and to heat treat them after machining to the required hardness. Frequently the hardening process is unsuccessful and the tools fracture during hardening or after a more or less protracted period in use.

Die breakage is frequently due to an unfavorable stress distribution in hardening, occasioned by temperature differences between the surface and the core arising out of the heat treatment. This effect occurs during heating to hardening temperatures, during quenching and tempering and is particularly pronounced in heavy dies. But, it is possible by suitable steps in the heat treatment of heavy dies to successfully harden the material with little risk. Heating rates for hardening or for tempering should be adjusted so that pronounced temperature differences and stresses are reduced to a minimum.

Data concerning minimum heating rates as a function of the die dimensions are not available in the literature. Therefore the heating periods up to hardening and tempering temperatures were calculated and corresponding curves sketched. A report has been rendered elsewhere regarding this work. (Haerterei-Technische Mitteilungen, Band 2, bei den Vortraegen des II. Haerterei-Kolloquiums.) Herein only the more essential data are reported:

Heat transmission can occur by conduction, convection or radiation. Below 930 deg. F. convection and overhead radiation are the predominant modes of heat transmission. The die surface is heated first and the core rises in temperature by heat conduction. Obviously the corners of the die which are exposed on three sides by the heat carrying medium (convection or radiation) and the edges exposed on two faces heat up much more rapidly than the center areas. This temperature differential between surface and core result in sizable stresses which may cause cracking in the core of the die, as is illustrated by Fig. 1. The more accentuated the temperature differential between surface and core, the heavier and heavier the stresses set up and the greater the danger of tearing.

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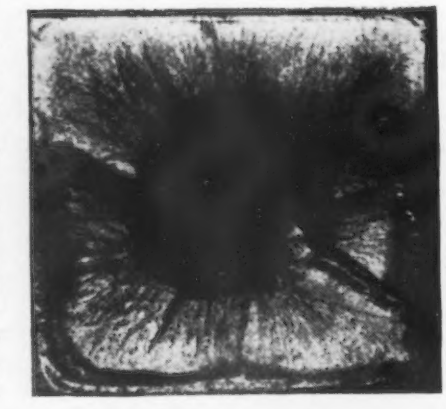

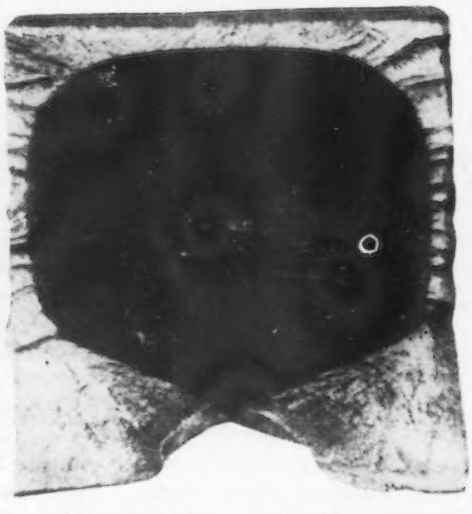

FIG. 1—Shrinkage cracks owing to too rapid heating. One-fourth natural size.

This temperature differential must be reduced to a minimum. As a base for this calculation, alloy steel drop forging dies 11 in. square and a hardening temperature of 1592 deg. F. were assumed. The influences of (a) the furnace temperature, (b) the rate of driving the furnace, (c) the die size, and (d) the heat conductivity of the die steel on the temperature gradient between surface and core of the die were calculated.

(a) An increase of *furnace temperature* increases the temperature differential between core and surface. According to Fig. 2 the hardening temperature of 1592 deg. F. can be reached after 8½ hr. at a furnace temperature of 1832 deg. F., but only after 10½ hr. at 1724 deg. F. This is not permissible in view of the possibility of tearing or overheating the die, particularly at corners and edges. This danger increases with the furnace temperature which should therefore not be chosen unnecessarily high.

Drop forging dies are usually heated in a muffle or a semi-muffle furnace, in which the rate of heating will be more rapid owing to the immediate flame contact. Particularly rapid will be the heating when a "driving flame" is used, for example, when special burners are used.

(b) *An increased rate of driving the furnace* by using a "driving flame" allowed the die surface to reach the hardening temperature after 5½ hr., while it needed 10½ hr. in normal heating. The maximum temperature differential between surface and core is about 25 per cent greater under the "driving flame."

(c) *The influence of the size of the die* was calculated and it was found that the temperature differential between core and surface of a die 11 in. square is a multiple of that existing in a die 3.9 in. square in which it is about 212 deg. F.

(d) The influence of *heat conductivity* is naturally according to the definition of that term.

The calculations agree with the practical experience. The temperature differential favors stresses and thereby increases the danger of tearing. Therefore, temperature differences

Heavy Forging Dies

By W. HAUFE Dr. Eng.
Dusseldorf

. . . These German suggestions for the proper handling of heavy drop forging dies during the hardening and tempering cycles are of interest in that they indicate thoughts on this important problem in that country. The ideas put forward may serve to stimulate the preparation of heating curves for steels and conditions other than those considered herein. This is a translation of an article that appeared in TZ fur praktische Metallbearbeitung, March, 1943.

must be kept at a minimum by suitable direction of the heating process, and definite minimum heating periods must be allowed for each die size. The heating rate is particularly dependent on the temperature difference between furnace and die, on the temperature conductivity of the die and on the rate of heat transmission. It is secondarily dependent on the relation between furnace size and die size. In the various shops these factors vary greatly and it will be difficult to arrive at generally valid conclusions, but in the following is shown a way in which the problem may be tackled:

During heating three steps can be distinguished: Heating up to 932 deg. F., heating from 932 deg. F. to the hardening temperature, and finally the period of penetration to equalize temperature differentials between the core and the surface of the die.

Up to 932 deg. F. heating must be particularly slow and thorough in order to keep the temperature differential between surface and core as low as possible. The steel is unable to absorb considerable stress in this temperature range. Therefore, it is best to heat the die with the furnace. In no case should the furnace be hotter than 392 to 572 deg. F., since otherwise, owing to the rapid heating of the die surface, interior cracks would be unavoidable (Fig. 1). Frequently the mistake is made that the hot furnace is cooled by a mere opening of the furnace door and charged too early. The pyrometer and the surface of the refractories actually register to a low temperature, between 392 to 572 deg. F., but the refractory bricks have stored so much heat that the die heats up very rapidly when the furnace door is closed again. Should the tool be charged to a hot furnace at about 392 to 572 deg. F., then under no circumstances should further heating be started immediately. The die block should first be given an opportunity to absorb approximately the furnace temperature and then further slow heating may begin.

Above 932 deg. F. it is possible to heat rapidly with a "driving flame." In this temperature range the steel can absorb even fairly heavy stresses without tearing.

When the hardening temperature is reached the furnace should be turned off and held there for some time. The calculation results for different drop forging die dimensions of alloyed steels are given in Fig. 3 as a function of the heating periods which have proved successful in two different works. This comparison shows a good agreement with the calculated heating periods.

The replies to a questionnaire sent to a number of firms showed that the ranges given for alloyed and unalloyed die blocks are valid for the determination of the heating period in hardening of drop forging dies in the semi-muffle furnace. The dies must always be heated slowly up to 932 deg. F. Only from this point on may "driving flame" be used.

Quenching Drop Forging Dies

Water, oil and air are used as quenching media in the hardening of dies. Water offers the most rapid and air the slowest quench action.

In the quenching process the heat is removed from the outer areas of the part more rapidly than from the core. Particularly rapid is the quench action exerted on the corners and edges which are surrounded on two or, three sides by the quenching medium. In hardening larger dies the more rapid quench action on corners and edges as compared with the center areas of the die can be clearly observed. While center areas are still dark red, corners and edges are already black. Owing to their more rapid cooling, the outer layers tend to contract but they are inhibited by the warmer core which is under pressure from all sides. Since the steel core cannot yield to this pressure, the colder layers must bulge out if they are still sufficiently warm and ductile. However, if the plasticity becomes too low with decreasing temperature then the surface will crack. On further cooling the core looses its volume. Since the core is held by the outside layers it in turn will now be exposed

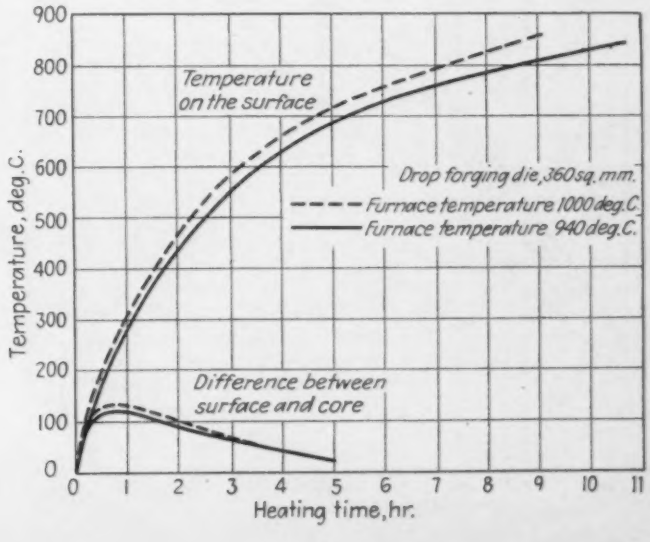

FIG. 2 — Influence of furnace temperature on the heating rate.

to tensile and the surface layers to pressure stresses. It is now possible for the core to disintegrate or to loosen itself from the outside. The temperature differential between surface and core parallels the magnitude of the heat stresses.

The influences of (a) the hardening temperature, (b) the die size, (c) the quenching medium, and (d) the heat conductivity of the die steel, on the temperature differential between surface and core of the die has also been calculated.

(a) The *hardening temperature* was chosen at 1436 deg. and 1544 deg. F. for water hardening, and 1526 deg. and 1652 dg. F. for the oil hardening material. Water hardening die steel begins to be rather rough grained at 1544 deg. F. Its toughness thereby is reduced and the danger of cracking increased. In the more rapid water hardening, the hardening temperature should be in no way higher than is absolutely necessary to obtain an evenly hard and sufficiently deep hardened layer. In hardening dies of alloyed steel it may become necessary to harden at the upper hardening temperature limit for adequate temper stability. The hardening temperature must in no case be so high that the toughness of the die suffers by the occurrence of a coarse grain.

(b) The influence of the *die size* upon the temperature course and temperature differential were calculated for die sizes of 3.9, 7.8 and 14 in. square. As material, carbon steel and a uniform hardening temperature of 1472 deg. F. were assumed. The temperature differential between surface and core reaches a maximum, according to Fig. 4, for all die sizes after a short interval, and then decreases extraordinarily rapidly for the small die sizes. With increasing die size this maximum differential is retained for increasingly long periods, for example in a drop forging die 14 in. square it is retained for several minutes and decreases slowly thereafter. As was to be expected, the maximum increases with the die size, since the heavier dies are hardened at the upper hardening temperature limit and temperature differential increases with the hardening temperature and these temperature differentials are further accentuated.

(c) In order to understand the effect of the *quenching medium* a uniform hardening temperature of 1472 deg. F. was assumed and the cooling curves for a die 14 in. square of carbon steel in air, oil and water were calculated. The temperature differential, according to Fig. 5, is by far the greatest in water hardening. In air cooling it is comparatively small. The temperature differential in air, oil and water quenching is related in the present example about as 1:3 and 6:8. The stresses will, therefore, be in a similar relationship. In practice the hardening temperature is considerably higher in oil hardening and particularly in air hardening than in water hardening. When the practical hardening temperatures were allowed for with 1490 deg. F. for water quenching, 1616 deg. F. for oil hardening and 1652 deg. F. for air cooling, then the temperature differentials for air, oil and water quenching are related as 1:3 and 4:7.

(d) As regards the influence of the *heat conductivity*, Fig. 6 shows that the temperature difference between surface and core increases with decreasing conductivity. Since the heat conductivity increases with increasing alloying constituents, alloyed steels are particularly sensitive in quenching, and the rate of quenching should, therefore, not be greater than the hardening requires.

It is permissible to conclude that the temperature differential between surface and core in hardening, and, therefore, the temperature stresses, increases with increasing quenching temperature, die size, quench action of the quenching medium and decreasing heat conductivity.

Temperature stresses are further enhanced by stresses in the crystal lattice which are caused by hardening.

In hardening, a space increase takes place when compared with the annealed condition which is connected with stresses. In water hardening steels the critical cooling rate affects only the outer layers in heavier sections. Therefore only the outer areas are actually hardened (Fig. 7). These steels are therefore also referred to as surface hardening steels. A hardening through of such steels occurs only

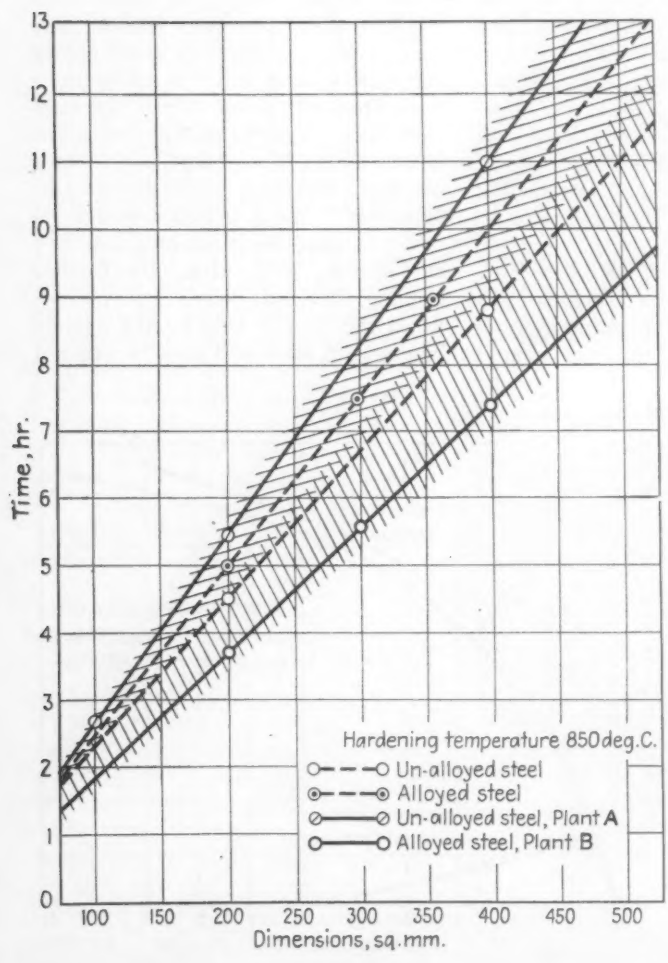

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FIG. 3 — Heating time for drop forging dies of different sizes.

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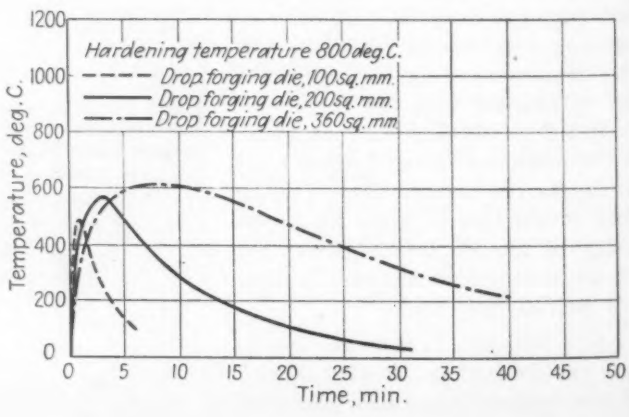
BELOW

FIG. 4 — Influence of drop forging die size on the temperature differential between surface and core.



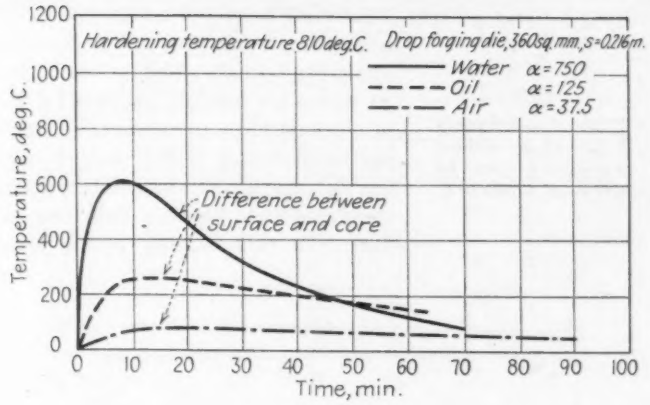


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FIG. 5 — Influence of quenching agent on the cooling rate.

perature be still too high then the quench is incomplete and it is possible that a tempering action occurs and the desired strength is ultimately not attained. If the dies are left in the quenching medium for too long the temperature stresses are again magnified and the purpose of "catching" is not attained.

The theoretical time necessary for "catching" various drop forging die sizes was calculated, permitting the core to drop to a temperature of 572 deg., 752 deg. or 932 deg. F. in oil hardening and 392 deg. or 572 deg. F.

when the sections are thin. In oil hardening steels the critical cooling rate is attained also in heavier cross-sections and in air hardening steels it is even reached with very large sections. Fig. 7 shows schematically the connection between the critical cooling rate and the deep hardening effect. Fig. 8 shows the hardness readings on a cut through a heavy drop forging die of air hardening CrNiMo steel. There is no practical difference between the core and the outer layers of the die.

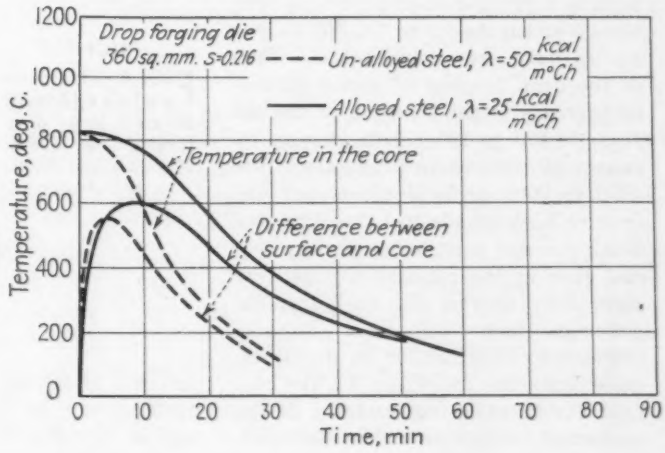

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FIG. 6 — Influence of heat conductivity on the cooling rate.

The hardening effect takes place by the action of stresses imposed by a space increase of the lattice in hardening. These stresses are particularly pronounced in their surface hardening effect and decrease with increasing penetration of the hardening action. In calculating the heat stresses in chromium steel of 15 in. and 9.8 in. diameter (Treppschuh, Arch. Eisenhuttenwes. 13, 1940, No. 10, S.429-36) found tensile stresses of 114,800 and 107,800 lb. per sq. in. respectively existing in the center. It is logical that heavier dies of water hardening steels frequently break in quenching. Since stresses of this magnitude are close to or exceed the limit of tensile strength of the material, only a very slight and hardly perceptible change in the hardening conditions is enough to cause an increase in the temperature or structural stresses and a breaking of the die. This effect offers also the explanation for the phenomenon that in the hardening of a number of dies under seemingly identical treatment, the one or the other breaks without an explanation becoming evident by later examination.

How is it possible to reduce the stresses which are caused by the quenching process or by the hardening so that hardening becomes fully successful?

The forgings determine the size of the drop forging die. The heat conductivity is determined by the steel used and cannot be influenced. The hardening temperature depends on steel and die size. All these factors are invariable.

In water hardening, the hardening stresses can be reduced by quenching in water into a jet with the engraved face first. The jet prevents the formation of steam bubbles in the engraving and takes care of an even and adequate quench action. The die is then pulled out of the water repeatedly to about two-thirds of its volume and whenever the back takes color it is plunged again into the water until the back remains dark. It is a great mistake to leave the dies in the quenching medium until they are completely cold. By this procedure tensions and the danger of cracking are unnecessarily increased. Dies should rather be so warm that they can be transferred into a tempering furnace while they are at 482 deg. F., so that oil or water can still evaporate. This method of hardening is being applied with success by experienced heat treaters. The time for "catching" the tool at the correct temperature is a matter of experience. The core temperature of the die should be a little lower than the projected tempering temperature when the tool is removed from the quenching medium. It must therefore be quenched for a definite period. Should the core temperature be still too high then the quench is incomplete and it is possible that a tempering action occurs and the desired strength is ultimately not attained. If the dies are left in the quenching medium for too long the temperature stresses are again magnified and the purpose of "catching" is not attained.

The theoretical time necessary for "catching" various drop forging die sizes was calculated, permitting the core to drop to a temperature of 572 deg., 752 deg. or 932 deg. F. in oil hardening and 392 deg. or 572 deg. F. in water quenching. The results are shown in Figs. 9 and 10. In using these data the influence of the engraving on the die thickness should be allowed for.

Tempering Drop Forging Dies

All drop forging dies must be tempered immediately after hardening to relieve heat stresses and to attain the required tensile properties. The performance of dies is influenced to a high degree by the choice of the most favorable tensile figure. This strength is determined by the material of the die, by its size, by the type and shape of the engraving, by the process in which it is used and by the plasticity and forging temperature of the material to be worked. The choice of the correct strength, therefore, presupposes very considerable experience. But it can be said generally that drop forging dies with flat engraving, particularly when hard materials are to be worked, require a very high tensile strength in order to avoid an early wear or the breaking off of any rapidly cooling ridges which the die face may have. Thus small dies, usually made from water hardening steels, such as those that are used for the manufacture of small steel parts such as scissors, are used at a hardness of about 65 Rockwell-C and tempered at

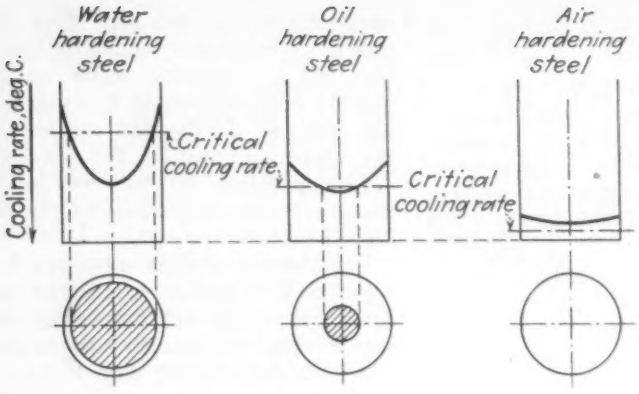

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FIG. 7 — Influence of the critical cooling rate on depth of hardening.

suited for the tempering of dies. Fig. 12 should be taken as guide for the approximate heating rate. Here are given the periods which are to be used as minimum heating periods for dies of various sizes to reach the tempering temperature of 1022 deg. F. without setting up considerable temperature gradients between core and surface. To this heating period which includes an adequate allowance for heat penetration additional time must be allowed for the structural reformation which is the effect of tempering. At dimensions below 15.6 in. square 2 to 4 hr. tempering is adequate.

about 302 deg. F. For flat engravings in drop forging dies of a medium size, tensile strengths up to 105,000 lb. per sq. in. have proved successful. Thus in the drop forging of motor pistons an increase in the strength of the die from 98,000 to 105,000 lb. per sq. in. caused an increase in production from 4000 to 6000 or 7000 pieces per die. In such high tensile tools bending and notch stresses must be avoided by special care in the construction and design. Drop forging dies with deep engravings have the most suitable strength at about 91,000 lb. per sq. in. since here the toughness of the tool is of the greatest importance. If the engraving is exposed to heavier notch actions then it is necessary to reduce the tensile strength to 77,000 lb. per sq. in. in more deep hardening steels. Fig. 11 shows a diagram of the relationship between various tensile strengths and tempering temperature for water hardening, oil hardening or air hardening drop forging dies.

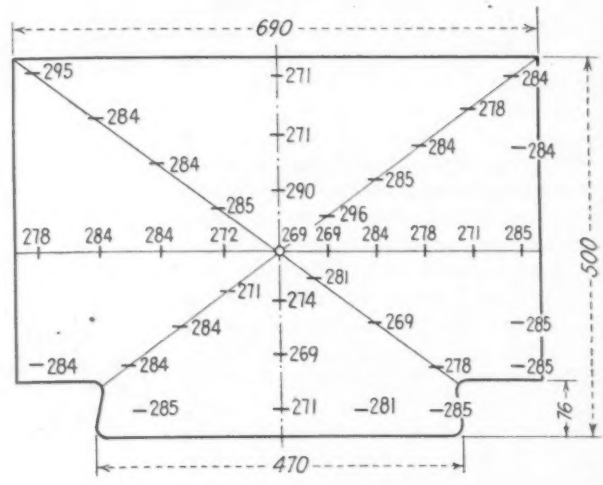

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FIG. 8 — Hardness values (Brinell) across a large drop forging die (26.9x 19.5 in.) of Cr-Ni-Mo steel.

respect. Hardened steel does not expand evenly on heating but at 212 deg. to 527 deg. F. a contraction occurs which favors the formation of heat cracks.

Hardened dies must, therefore, be heated especially slowly and carefully in tempering in order to prevent the formation of cracks. Muffle furnaces in which the rate of heat transmission is comparatively slow are well

While any cooling rate is correct for most tool steels after tempering (that is after hardening and following tempering at high temperatures) and without considerable effect on their properties, certain steels lose toughness in slow furnace cooling than if cooled more rapidly. Such steels are referred to as being temper-brittle, and Mn and Cr-Ni steels are particularly temper-brittle while steels containing W or Mo are not sensitive toward temper embrittlement. The temper-brittleness is bound to a temperature range at about 932 deg. F., an area which is also used for the tempering of drop forging dies. Today this temper-brittleness need not be

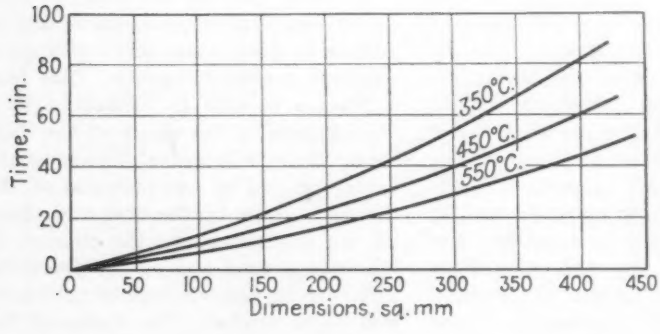

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FIG. 9 — Cooling time in oil for a core temperature of 350 deg., 450 deg. and 550 deg. C. (662 deg. 842 deg. and 1022 deg. F.)

After hardening, the die steels have a very great hardness, but are correspondingly weak toward notch or impact stresses. Furthermore it must be observed that the heat conductivity depends on the structure and is reduced by hardening. Heat conductivity is particularly poor in alloyed steels but with increasing temperature this difference becomes less pronounced so that at higher temperatures alloyed and unalloyed steels exhibit no marked difference in this

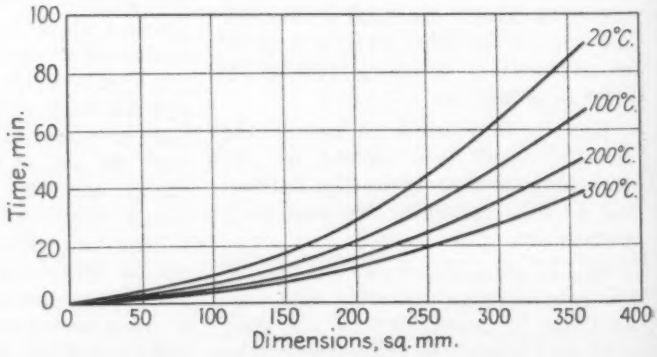

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FIG. 10 — Cooling time in water for a core temperature of 20 deg., 100 deg., 200 deg. and 300 deg. C. (68 deg., 212 deg., 392 deg. and 572 deg. F.)

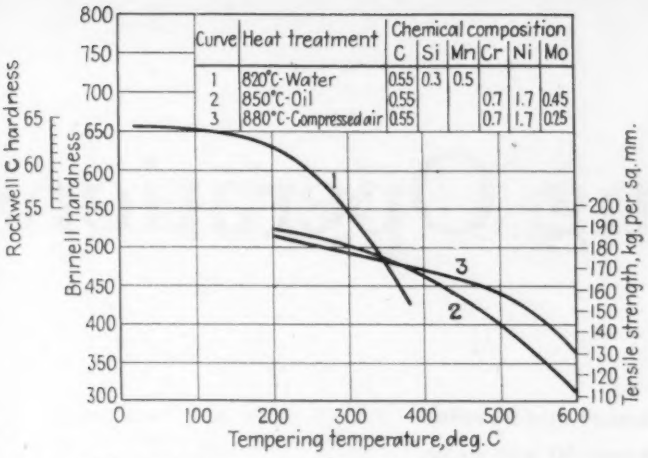
Curve | Heat treatment | Chemical composition C | Si | Mn | Cr | Ni | Mo
1 | 820°C-Water | 0.55 | 0.3 | 0.5
2 | 850°C-Oil | 0.55 | | | 0.7 | 1.7 | 0.45
3 | 880°C-Compressed air | 0.55 | | | 0.7 | 1.7 | 0.25
Rockwell C hardness
Brinell hardness
Tensile strength, kg. per sq. mm.
Tempering temperature, deg. C

FIG. 11—Influence of tempering temperature on the strength of some drop forging die steels.

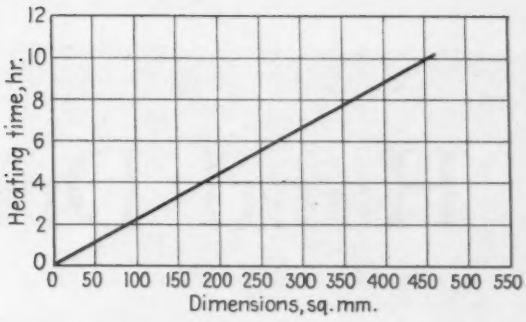

FIG. 12—Heating rates on tempering of drop forging dies of different sizes (tempering temperature 550 deg. C., or 1022 deg. F.)

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feared in the heat treatment of drop forging dies since the alloyed die steels usually contain up to 0.5 or 0.3 per cent Mo. Experience has taught that temper-brittleness can be prevented by rapid cooling through the brittle area at 932 deg. F. It is, therefore, necessary to temper steel susceptible to this embrittlement at above 1022 deg. F. and to quench in oil. A secondary tempering at about 482 deg. to 572 deg. F. for the removal of quenching stresses must then be resorted to.

The dies, still hot from hardening, are placed into a tempering furnace at a uniform temperature of about 482 deg. F. On no account should the refractories be considerably hotter in their interior than on the surface. After charging the furnace, a protracted period is allowed for the furnace to attain equilibrium. Then heating begins slowly. To calculate the heat penetration periods, the use of the curve shown in Fig. 12 may be useful. After tempering, the drop forging dies are best cooled in the furnace down to about 572 deg. F. in order to avoid stresses. Further cooling may then proceed in air. This mode of cooling is permissible for all drop forging steels, except those susceptible to temper-brittleness.

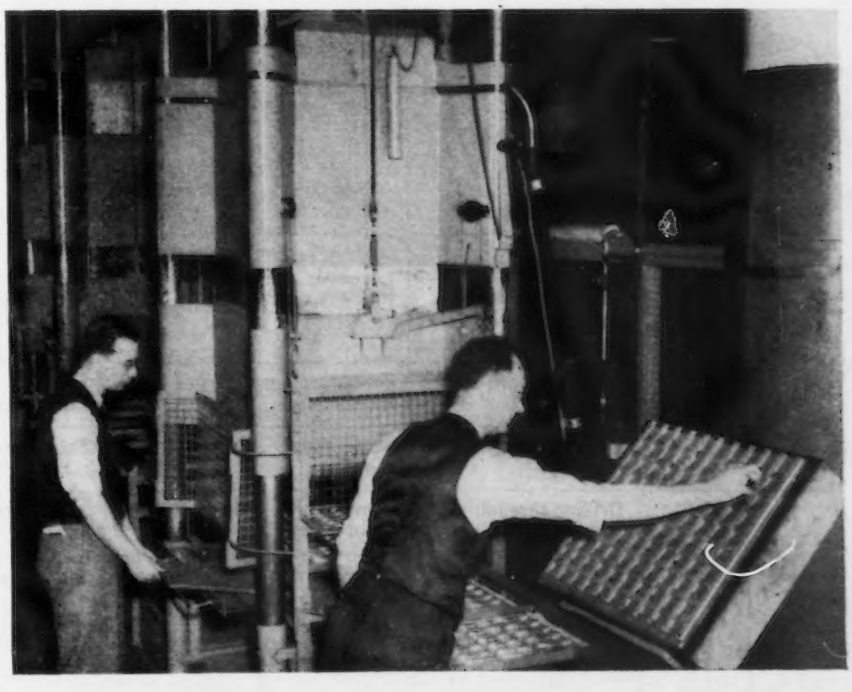
The above ideas have been put forward in order to stimulate heat treating departments to consider these problems more thoroughly and to draw up heating curves for the operating conditions which they encounter in their work. The curves given herein should be considered a guide.

Translated by C. M. C.

X-Rays Made on a Mass Production Basis

THE assembly line technique has now been applied to X-raying to enable high speed inspection of strategic castings. The important unit in this machine is a conveyor 40 ft. long that carries the castings before the X-ray equipment. Castings move along the conveyor in trays that stop automatically before the X-ray where exposures are made at a rate of 2 pictures per min. or one completely inspected tray containing from one to 20 parts, every 30 sec.

Another feature of this machine is the ¼ in. lead lined hood which drops over the tray and protects the operators from X-radiation. Although designed to inspect engines and fuselage castings of aluminum up to 5 in. in thickness, the machine can be adapted readily to other metals. This X-ray machine was developed jointly by the X-ray Division of Westinghouse and by engineers of the Ternstedt Division of Fisher Body, Detroit.



Hand Drilling Operations

. . . A system of using a self-centering drill attachment and beveled guide holes in a panel jig has reduced drill breakage 50 per cent, reduced time of drilling and improved quality in aircraft fuselage manufacture. Many other advantages are cited.

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IN determining the most efficient method of drilling rivet holes in the assembly stage of fabricating aircraft structures use of a self-centering device on the hand drill nose in conjunction with a beveled drill guide was found to be far superior to other methods in use at Lockheed Aircraft Corp.

The device consists of a spring guard self-centering tip attachment which sets into 60 deg. countersunk holes in a panel drill jig, Fig. 1. As pressure is applied to the hand drill, the surface of the countersunk hole automatically guides the spring tip and hence the drill to the center of the hole. This method of drilling can be applied wherever a guide strap can be used, but is most suitable for bulkhead and skin intersections or bulkhead stringers, Fig. 2, and skin intersections or the seams for mating of panels. Aside from reducing the time of drilling tremendously, the device reduces drill breakage 50 to 80 per cent. This is an important factor in view of the fact that as many as 136,000 drills have been broken in a single month.

A series of time studies were made to determine which method of drilling will be most advantageous and also provide the widest range of standardization possibilities. The time studies were made under normal working conditions in various work areas, with average operators. A minimum of 10 tests with 10 operators were made and the average time for 100 operations recorded. The overall time for the drilling operation on each assembly was also noted. The variations in time and efficiency for the five methods studied are shown in the table.

Method A is one of drilling through pre-drilled holes in bulkheads, ribs and stringers. No drill jig is used since the pilot holes in the parts are used to locate the drill, although this structure requires the use of a panel jig to hold the parts together. The average time recorded was 5.23 sec. for each hole drilled and was the highest of all methods studied. The reason for the amount of time required to drill the holes is due to obstructions on the inside of the assembly, which in the tests were forward fuselage panels. Also, the holes are usually drilled at an angle to the surface and considerable searching is required by the operator to find the pilot holes. In this operation extension drills are used which are both slow and dangerous. The time study indicated that a very high percentage of rework is required to meet inspection requirements.

Method B is one of drilling through pilot holes in pre-drilled skin. No drill jig is used. A panel jib with locators is required in this operation but the locators do not hold the ribs in a definite position since the ribs must be moved to line up with the pilot holes in the skin. Alining the ribs with the pilot holes in the skin is both difficult and slow and shows a considerable amount of inaccuracy. The average drilling time was recorded as 3.69 sec. for each hole which included 0.12 sec. for average layout and 0.32 sec. for

TABLE I

A Comparison of Various Drilling Methods Tested at Lockheed

Method	Average Time in Sec. for Each Hole Drilled	Description of Operation	Specific Application	Working Conditions	Inspection
A	5.23	Pre-drilled ribs, bulkheads, stringers	Forward fuselage part	Normal	High percentage of rework required
B	3.25	Pilot holes pre-drilled in skin	Center section trailing edge	Normal	Fairly satisfactory
C	2.14	Drilling through jig bushing	Bomb door panel	Normal	Satisfactory
D	4.21	Drilling through template over skin	Bomb door panel strips	Normal	Satisfactory
E	1.40	Drilling through 60 deg. countersunk holes in drill jig	Experimental setup	Experimental setup Approximates normal conditions	Satisfactory

Speeded Up

RIGHT—ABOVE

FIG. 1—A 60 deg. beveled drill tip about to enter the beveled drill hole in a panel drill jig. This drill tip contacts anywhere within the beveled hole and automatically guides the drill to the center of the hole.

RIGHT

FIG. 2—Application of the beveled drill guide and self-centering drill to drilling skin attachments to bulkhead stringers.

router drilling time. Considerable damage to the skin around the holes was recorded for this method. In guiding the drill through the pilot holes the surface of the skin around 5 per cent of the holes was scratched by the point of the drill. The percentage of rework for this type of drilling is fairly satisfactory as far as inspection is concerned.

Method C is one using drill bushings in a jig. The tooling requires the use of a panel jig, locators and stiffeners, together with the drill jig. The average drilling time recorded was 2.14 sec. for each hole which is next to the lowest in this survey. This method is fairly satisfactory because no pilot drilling or layout work is necessary. However, the following disadvantages were recorded:

1—High drill breakage.

2—High cost of tooling (making and inserting bushings).

3—High tool maintenance, approximately 4 hr. per month for each jig (bushing replacement).

4—Inability of operator to see holes that are drilled, causing delay and some possibility of skipped holes.

Method D is one of drilling through a drill template placed over the skin. A panel jig and a spring loaded attachment for the electric drill are used in the tooling. The time recorded for this method was 4.21 sec. for each hole and is next to the highest time recorded during the study. The increased time is due to the difficulty of centering the drill attachment in the holes in the template. This type of drilling is satisfactory as far as inspection is concerned but is limited to small panels or strips and must be used with the template placed in a horizontal position.

Method E is the one of drilling through a drill jig which contains 60 deg. countersunk holes, Fig. 1. This type of drilling was tried out as an experimental setup approximating normal conditions. The time for drilling was 1.4 sec. for each hole, lowest recorded, and the investigation disclosed that this was by far the most efficient method studied, both from the standpoint of standardization possibilities and majority of advantages. This method is more than three times as fast as the lowest time recorded for the other methods. This is without taking into consideration the additional time saved by eliminating the pilot dressing operation on skins and structural members, which time factor was found to be surprisingly high, especially when considered as a duplicate operation.

The following is a summary of some of the advantages recorded for the self-centering drilling method:

1—Reduces tool cost since bushings are eliminated.

2—Reduces tool maintenance because there is no wear on drill guide holes, and no bushing replacement is necessary.

3—Reduces drill breakage 50 to 80 per cent.

4—Does not mark skin with drill point.

5—Speeds drilling operation from 50 to as high as 300 per cent.

6—Permits use of inexperienced operators.

7—Reduces hazard to other workers to a minimum, as drill point barely extrudes from metal.

8—Requires no wax or other lubricants such as used on drill bushings.

Surface Protection of Aircraft Parts

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IN these days of material substitution directives and consequent new inorganic finishes, dissimilar aircraft construction metals must frequently be used in combinations whose corrosion service life is not fully known. The increasing importance placed upon material availability, weight, strength, and protection in present aircraft design necessitates the use of materials in faying combinations hitherto not considered feasible. Galvanic couples now merit much closer attention by designers than was previously necessary. Low carbon steel and new aluminum alloys are being used in combinations which, upon exposure to corrosive liquids or moisture, may be affected by galvanic corrosion.

When two different metals are connected to each other in the presence of any electrolyte one metal is attacked at a much faster rate than it would be, if exposed separately. The other metal either remains free from attack or is corroded at a considerably slower rate. Because corrosion of this type is caused by the generation of a tiny electric current between the battery-like plates, it is described as "galvanic corrosion." It is this galvanic effect that speeds up the corrosive action beyond the ordinary rate. The metal which is corroded by this action is said to be "anodic" and the metal which it protects is termed "cathodic." Corrosion engineers also speak of the cathode as the more noble metal and the anode as the less noble metal—using the word "noble" in a broader sense than its original meaning which referred to the acid insolubility of precious metals such as gold and silver.

Studies of galvanic corrosion have made it possible to arrange metals in a galvanic series which shows the tendencies of metals and alloy to form significant galvanic cells and the probable direction of the galvanic effects. Within this series the metals and alloys are divided into groups. Those grouped together have no strong tendency to produce galvanic corrosion with each other and therefore are relatively safe to use in contact with each other unless the area of the less noble metal is markedly smaller and the metals fall some distance apart in the group. The coupling of two metals from different groups and distant from each other in the list will frequently result in galvanic corrosion of the less noble metal. The farther apart the metals stand in the series, the greater will be the tendency for galvanic action to take place.

Galvanic Series

Corroded End (anodic or least noble)
- Magnesium
- Magnesium alloys
- Zinc
- Aluminum 2S
- Aluminum 52S
- Aluminum 53S
- Aluminum 61S
- Cadmium
- Alclad 17ST
- Alclad 24ST
- Aluminum 17ST
- Aluminum 24ST
- Steel or iron
- Cast iron
- Chromium iron (active)
- Ni-Resist
- 18-8 stainless (active)
- 18-8-3 stainless (active)
- Lead-tin solders
- Lead
- Tin
- Nickel (active)
- Inconel (active)
- Brasses
- Copper
- Bronzes
- Copper-nickel alloys
- Monel
- Silver solder
- Nickel (passive)
- Inconel (passive)
- Chromium-iron (passive)
- 18-8 Stainless (passive)
- 18-8-3 Stainless (passive)
- Silver
- Graphite
- Gold
- Platinum

In a particular galvanic combination, the relative areas of the two materials forming the couple have a very important bearing on the extent of corrosion. Under most conditions the extent of galvanic corrosion for any metallic couple will be very nearly proportional to the ratio of the area of the cathodic metal to the area of the anodic metal. Thus, if a piece of aluminum having a surface area of 2 sq. in. is coupled to a piece of steel with a surface area of 100 sq. in., the galvanic corrosion is roughly 50 times faster than it would be if the same piece of aluminum were coupled to a piece of steel having a surface area of 2 sq. in. For this reason, it is wise to avoid galvanic couples where the exposed area of the metal lower in the galvanic series is much greater than that of the metal higher in the series. As a practical example, it would not be safe to use a steel rivet in a monel plate, but reasonably safe to use a monel rivet in a steel plate.

To control galvanic corrosion, combinations of metals should be selected that are close together in the galvanic

series. Designs in which the area of the anodic material is relatively small should be avoided. It is good practice to use the cathodic metals for fasteners or clips in equipment built largely of less corrosion resistant material such as aluminum and magnesium. Dissimilar metals should be insulated wherever practical. Perfect insulation will prevent current from being generated by the two plates and hence the anodic plate will not be consumed or corroded. If complete insulation cannot be achieved, materials such as paint or plastic coatings between seams to increase the internal resistances of the small galvanic cell with reduce the corrosion.

Materials well apart in the series should not be joined by threaded connections as the threads will deteriorate excessively. Brazed joints should employ a brazing alloy more noble than at least one of the metals to be joined. Whenever possible, small, replaceable sections of the anodic material should be installed at joints and the thickness of the anodic material should be increased. For example, extra heavy wall nipples should be used in piping, or replaceable pads should be attached in the vicinity of galvanic contact.

In finishing assemblies containing dissimilar metals, parts should be finished in detail whenever possible in order that faying surfaces on individual parts may receive greater protection.

The following finishes are necessary for satisfactory protection of dissimilar metals:

Steel Parts: Cadmium plate plus zinc chromate primer, or phosphate treatments, such as Bonderizing and Parkerizing plus zinc chromate primer. (This finish is used whenever possible in order to conserve cadmium.)

Aluminum Alloys: Anodize plus zinc chromate primer, or Alrok plus zinc chromate primer.

Alclad 17S and 24S: Chromodize plus zinc chromate primer.

Magnesium Alloys: Dow 7 treatment plus two coats zinc chromate primer, and two coats lacquer, or magnesium anodic treatment plus zinc chromate primer.

Brass, Bronze Alloys: Cadmium plate.

Spotwelded assemblies present a problem in finishing, since parts cannot be finished in detail prior to spotwelding. Detail parts must be etched in chemical solutions to be absolutely free from contamination and oxides prior to being welded. Chemical etching solutions used to etch aluminum alloys will attack steel parts and remove plating or phosphate treatment. Faying surfaces cannot be protected. Parts having protective coatings such as anodize, Parkerize, Bonderize or paint cannot be spotwelded. Chemical solutions used in applying protective coating to finished assemblies may be entrapped in faying surfaces and cause serious damage. The treating of large assemblies to protect a few small parts is not economical. Spotwelded assembly design must incorporate a minimum of metallic combinations with high galvanic potentials.

. . . In this description of the research program carried out by Lockheed Aircraft Corp., in an effort to solve finish problems arising from the increased use of low carbon steels in place of nickel-bearing stainless steels, the growing importance of galvanic corrosion in aircraft construction is stressed and fundamental concepts of this type of corrosive attack are discussed. The results of investigations on comparative protection afforded by various combinations of phosphate treatments and additional coatings are also given, and finishes now in use on various steel parts are listed.

Parkerizing Tested

The growing use of low carbon steel in aircraft structures presents the problem of the protective finish for such assemblies as heat exchangers, fire walls and flame-arresters. The phosphate treatments, such as Parkerizing and Bonderizing, lend themselves well to aircraft production. However, the limitations of the processes in plane production have not been fully understood because of the industry's relative restricted use of the Parkerizing process prior to the stainless steel substitution program. The designer and the production man must know which assembly combinations can be routed through the Parkerize process without danger of chemical action on any of the components. In developing the Parkerizing process for use on aircraft parts of low carbon steel, tests were undertaken by Lockheed Factory "A", successor to Vega Aircraft Corp., to determine the following information:

(1) A type of proprietary alkaline cleaner which cleans effectively but does not produce a coarse crystalline coating on the Parkerized part.

(2) Average thickness of Parkerized coating obtained by 30 min. immersion in Parco solution.

(3) Effect of Parkerizing solution on nonferrous metals and stainless steel.

(4) Hydrogen embrittlement of springs and high carbon steel by Parkerizing process.

(5) Relative corrosion resistance of coarse and fine grained Parkerized Coatings.

(6) Effect of Parkerizing solution on fiber inserts of elastic stop nuts.

Cleaning Effect on Parkerizing

To test cleaners and cleaning procedures, panels of 1010 steel, 0.018 x 3 x 5 in., coated with fish oil from the original sheet stock and Shell Clava 37-E rust preventive oil were prepared. Two panels were cleaned at 190 deg. F. by each of treatments listed in column 2 of Table I at the concentration and for the time specified in columns 3 and 4. Panels were agitated by hand in the soap solution and then rinsed in clear water at 190 deg. F.

Immediately after cleaning, panels were Parkerized for 30 min. Specimen Nos. 1' through 16' were coated with Turco "Rust Evade" compound and then scratched diagonally on one side. The original Parkerized coat remained on the other side. These panels were sent to Triplett & Barton Co., a commercial testing laboratory, for salt spray tests in a cabinet conforming to Specification AN-QQ-S-91. Specimens 1 through 16 were examined microscopically to determine the crystalline character of the Parkerized phosphate coating. These samples were also sent to the Triplett & Barton laboratory where the thickness of the coating was measured microscopically and with a "Magne-Gage."

The results of cleaning tests in relation to the quality of the Parkerized coating obtained as shown by microscopic examination are shown in column 6 of Table I. The salt spray test showed that Parkerizing was not seriously affected by any of the cleaners. All the samples from 1' through 16' showed beginnings of rust in 30 hr. on the "Parkerize only" side and in 75 hr. on the side coated with Turco "Rust Evade" over Parkerize. These samples all showed general rusting in 175 hr. It is evident that coarse or fine grained Parkerized coatings when finished with suitable rust preventive compound or paint type finish are approximately equal in corrosion resistance.

The alkaline cleaners which give a most satisfactory Parkerize are Nobs No. 788, Turco Prosolv, Turco Airlion 81, and Turco Airlion 81-V. Excessively greasy parts may go directly from a trichlorethylene degreaser to the Parkerizing tank. Parts which are coated with some insoluble matter, such as paints or dyes, should receive a solvent wipe to assure complete removal of the coating.

Table II shows thickness of Parkerized coating for each specimen as measured on the microscope and with the Magne-Gage. The values reported represent the average thickness along the length of the specimen.

Parkerizing Effect on Other Metals

To study the effect of the Parkerizing solution on non-ferrous metals and stainless steel, production assemblies of 1010 steel containing copper, brass, bronze and 302-1A stainless steel were processed in the Parkerizing solution. Cadmium plated tubing, cadmium plated Dzus springs, and three anodized aluminum alloy castings were also Parkerized. The anodized aluminum castings, together with a control casting which was not Parkerized were subjected to a salt spray test. The results were as follows:

Effect of Parkerizing on Anodized Aluminum Castings as Shown by Salt Spray Test

Specimen Number	Parkerizing Time, Min.	Hours Until First Corrosion
1	None	75
2	10	30
3	30	30
4	30	30

The castings turned a light brown when Parkerized. A definite etching of the aluminum was observed. It is obvious that production assemblies of steel which contain aluminum castings cannot be Parkerized after the castings have been attached to the assembly. Design and production breakdown of assemblies must provide for attachment of aluminum alloy detail parts to the main assembly after it has been Parkerized.

From an examination of the production assemblies containing nonferrous detail parts, it was evident that the Parkerizing solution did not react with copper, brass and bronze on production parts. A few scattered phosphate crystals were formed on stainless steel but no detrimental effect was noted. A dark phosphate coating was formed on cadmium plated tubing and Dzus springs but the plating was not removed. Lockheed Factory "A" now permits the Parkerizing of assemblies containing components of copper, brass, bronze or cadmium plated parts.

Hydrogen Embrittlement

To determine the hydrogen embrittlement effect of Parkerizing on cadmium plated parts, Dzus springs and music wires of 0.032 and 0.015 in. diameter were Parkerized for 30 min. at 195 deg. F. Immediately after being processed, separate Dzus springs (a) were bent through 90 deg., (b) bent through 90 deg. and then back through 180 deg, (c) coils which had been formed before tempering were straightened out. Five days later, different samples were bent through (d) 90 deg. and (e) through 90 deg. and then back through 180 deg. Samples were held in a vise and bent around a radius of approximately 1/16 in.

The freshly Parkerized 0.032 music wire was coiled around a 1/64-in. radius for five 360 deg. turns. The 0.015 wire was bent into a five 360 deg. coil spring with almost no radius. After five days samples of Parkerized wire were bent as in (d) and (e) above. Neither the music wire nor the Dzus springs showed any signs of cracking or breaking. Both these items are subject to hydrogen embrittlement when cadmium plated. Since none of the samples showed any tendency to crack or break, it may be presumed that Parkerizing does not embrittle high carbon steels used in aircraft assemblies and that such assemblies may be safely Parkerized.

Effect on Stop Nuts

Twelve elastic stop nuts of two different types with vulcanized fiber inserts were Parkerized for 30 min. at 200 deg. F. An equal number of un-Parkerized control samples were also included in the test. Measurement of swelling of the inserts was accomplished by inserting into the nuts a tapered glass rod 9/64 in. in diameter at the small end. Tightness of bolts in the nuts was determined by screwing bolts into Parkerized and un-Parkerized nuts immediately after the test, two days after and two weeks after. Variations in tightness were measured by a torque wrench. Parkerized stop nuts were also heated for 1 hr. at 120 deg. and 190 deg. F. and torque tested in comparison with un-Parkerized stop nuts.

A slight swelling of fiber inserts in Parkerized nuts was shown by the fact that the tapered rod could be inserted into the un-Parkerized nuts but not into the Parkerized nuts. When bolts were screwed into Parkerized and un-Parkerized nuts, the Parkerized nuts were tighter by torque in all cases. In no case did fiber chip or crack when bolts were screwed into nuts which had been Parkerized and then dried at room temperature. Fiber cracked when bolts were inserted into Parkerized nuts which had been dried at temperatures of 120 and 190 deg. F. The inserts did not crack on the un-Parkerized stop nuts which had been dried at elevated or room temperatures.

Protective Finish for Tubing

When low carbon steel tubing was substituted for corrosion resistant tubing on propeller feathering lines, a suitable corrosion resistant finish was necessary since these low carbon steel alloys corrode quite rapidly in service. Parkerizing was chosen as the basic inorganic finish and various primer and rust preventive applica-

TABLE I

Panel No.	Cleaning Treatment	Cleaner Concentration, Oz. Per Gal.	Cleaning Time, Min.	Water Break	Parkerized Coating Grain Structure
1, 1′	None	..	No Rinse	....	Coarse
2, 2′	Vapor degreaser	..	..	....	Coarse
3, 3′	Nob's 717XX	6	10	Fair	Coarse
4, 4′	Nob's 788	4	10	Good	Fine
5, 5′	Nob's 777F	6	10	Good	Coarse
6, 6′	Nob's 789D	4	10	Fair	Coarse
7, 7′	Solvent Wipe	..	No Rinse	....	Coarse
8, 8′	Oakite Railroad	8	10	Fair	Coarse
9, 9′	Turco Prosolv	6 (pH 8.5)	5	Good	Fine
10, 10′	Turco Prosolv	6 (pH 10.0)	5	Fair	Coarse
11, 11′	Turco Prosolv	6	10	Fair	Coarse
12, 12′	Turco L-646 (Diluted 1 to 4 with water)	..	Wiped on	....	Coarse
13, 13′	Turco Airlion 81-V	6	10	Good	Fine
14, 14′	Turco Petmusel	6	10	Fair	Coarse
15, 15′	Turco Airlion 81	6	10	Good	Fine
16, 16′	Turco Type X	6	10	Good	Fine

tions over the Parkerize were comparatively tested.

Tests were conducted on 10 samples of 1010 steel tubing to see whether Parkerizing the tubes and then applying rust preventive compounds or zinc chromate primer would be satisfactory. The samples were finished as follows:

Sample No. 1 was Parkerized and two spray coats of zinc chromate primer were applied outside.

Sample No. 2 was Parkerized and two spray coats of zinc chromate primer were applied inside and out.

Sample No. 3 was Parkerized and one dip coat of zinc chromate primer was applied outside while sample No. 4 had the same treatment but the primer was applied inside as well.

Samples Nos. 5 and 6 were Parkerized plus one dip coat of Rust-Evade rust preventive compound.

Samples Nos. 7 and 8 were Parkerized plus one dip coat of Paralketone rust preventive compound.

Samples No. 9 and 10 were Parkerized and one dip coat of No-Oxide-E rust preventive compound was applied.

All samples were exposed in a salt spray cabinet for 250 hr. and checked every 24 hr. for effects of the salt spray on the finish.

During the first 24 hr. no corrosive action was observed on any of the tubes. At the end of 48 hr. pitting was noted on samples 1, 2, 3 and 4. At 72 hr. all tubes showed slight pitting except sample 5. No appreciable change in the condition of the samples was noted after 96 hr. After 120 hr., rust spots were present on all but Nos. 5 and 6, although sample 5 began to show pits. For the next four days (216 hr.) a fairly uniform rate of attack was noted on all tubes with the exception of Nos. 7, 8, and 10 which were definitely corroded. At the conclusion of the 250 hr. period, rust was present to a certain extent on all tubes. The interiors of tubes 1, 4 and 7 were somewhat corroded as were the ends of Nos. 5, 6, 8, 9 and 10.

By estimating the extent of exterior surface corrosion of each tube the following percentages were established.

Sample No.	Extent of Corrosion Per Cent
5	5
1, 4 and 6	10
2 and 3	15
7 and 9	25
8 and 10	50

TABLE II

Thickness of Parkerized Coatings

Specimen Number	Thickness, In.	
	Microscopic	Magne-Gage
1	0.0005	0.0002
2	0.0005	0.0002
3	0.0005	0.0003
4	0.0005	0.0003
5	0.0004	0.0003
6	0.0004	0.0003
7	0.0005	0.0002
8	0.0005	0.0003
9	0.0003	0.0002
10	0.0004	0.0003
11	0.0004	0.0003
12	0.0004	0.0003
13	0.0004	0.0003
14	0.0004	0.0003
15	0.0004	0.0003
16	0.0004	0.0003

Note: It will be noted that there is a discrepancy between measurements made on the microscope and those made with the Magne-Gage. It is believed that the Magne-Gage measurements are the more accurate because they are not affected by the metal flow which takes place during the polishing of miscroscopic specimens.

It is evident that tubes 5 and 6 which were coated with Turco Rust-Evade withstood salt spray corrosion most successfully. Tubes 1 and 4 coated with zinc chromate primer were also satisfactory. The other finishes were considered to be unsatisfactory. Although no direct relation can be established between salt spray cabinet exposure and actual service conditions, it has been the experience of Lockheed Factory "A" that a finish which apparently excels in a salt spray test also exhibts service performance characteristics superior to finishes against which it has been tested.

Other Finishes

Additional tests to determine suitable corrosion resistant finishes for low carbon steels showed that Bonderized surfaces are good bases for paint adhesion and can be coated with zinc chromate primer or heat resistant finishes. When Bonderized surfaces are coated with zinc chromate primer, they have good corrosion resistant properties and can be used in contact with dissimilar metals. A 10 min. Parkerize treatment also gives a good base for paint adhesion. Increases in corrosion resistant qualities can be obtained by the use of rust preventive compounds. Since Bonderize or short Parkerize treatments facilitate production, they are to be preferred whenever optimum protection is not required. The design, location in the airplane, and function of the part must be considered in choosing an adequate finish.

It has been found that a 30 min. Parkerize has good heat resistant qualities at 650 to 700 deg. F. and can be used as a base for heat resistant finishes. These Parkerized surfaces when coated with zinc chromate primer have excellent corrosion resistant properties and can be used in contact with dissimilar metals. Bonderized or Parkerized materials coated with zinc chromate primer have corrosion resistant qualities equal to those of a 0.0003 in. thick cadmium plate and are more heat resistant.

Porcelain enamel should be used on materials which must withstand high heat. All forming, welding and assembling must be complete before porcelain enamel can be applied.

The following finishes are in use at Lockheed Factory "A" at the present time:

Firewalls, cowl flaps, manifold outlet cover, webs and brackets—Bonderize plus two coats of zinc chromate primer.

Cowl wells, nose ring and cowling and nacelle doors—Parkerize plus two coats of zinc chromate primer.

Power plant supports, power plant brackets, motor mount and bay supports — Parkerize plus synthetic enamel.

Steel parts on interior of cabin such as cabin door hinge, brackets, supports, control rods, etc.—Bonderize and two coats of zinc chromate primer.

Steel parts on exterior surfaces and wings, landing gear supports, braces and steel parts in bomb bay—Parkerize and two coats of zinc chromate primer.

Steel bolts and pins where wearing surface is not critical—Parkerize and rust preventive oil or compound.

Exhaust stacks and other "hot" components of the exhaust system—Porcelain enamel.

If the present trend toward low carbon steels and their phosphate finishes continues, the materials which they are replacing may experience considerable difficulty in regaining their former usages. At the present rate of technical development, the new materials and finishes will offer adequate protection at reduced cost in the postwar airplane.

Cost of Meehanite Castings vs.

FOR some years I have watched with admiration the brilliant and aggressive educational campaign fostered by the various members of the American Welding Society and by welding equipment makers. Their goal has been to show how it can be done better and cheaper by welding. They have proved their point on structures of many designs at various levels of production, until they have made the development of welding one of the outstanding developments of the past two decades. In fact progress in welding technology and design has been so effective that no machinery builder can now afford to neglect what is going on in that field. Most of us therefore have developed welding departments staffed with capable men and have trained our engineers in the design of welded structures, so that we can keep in intimate contact with the progress of the welding art and thus take full advantage.

The point is made that this attitude on the part of machinery builders didn't just emerge. It was fostered by the intelligent, widespread and wholly justified publicizing of the welding industry's amazing progress both in welding technique and in the remarkable extent of its application. Although the progress of foundry technology has been little less astonishing, this progress, which is changing molding from an ancient art into one of the most modern of sciences, has not been effectively publicized and thus is not commonly recognized.

Very little definite information has even been published about the relative cost of high-duty iron castings compared to weldments. Articles on welding have appeared which seem to imply that regardless of the character of a structure or its rate of production, it can be designed to be produced more cheaply as a weldment than as a casting. In contrast to this implication, our experience is worth recording, because it is verified by the experience of so many other heavy machinery builders.

Welding Shop Set Up

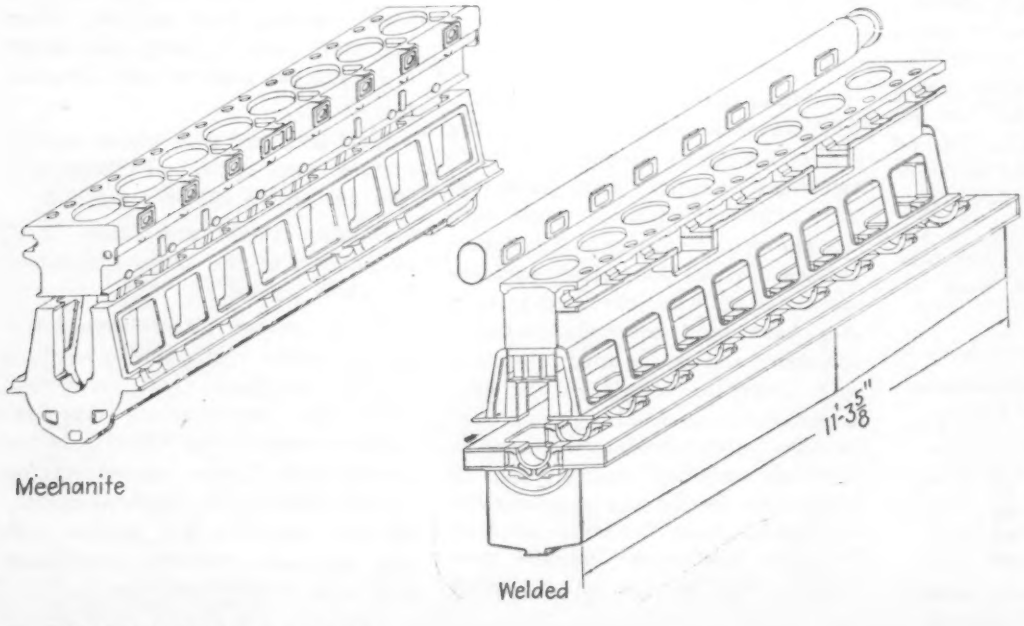
Back in 1929 we began a long-range program aimed at the improvement of our welding department. It was quite apparent then that certain structures needed in our business could be produced more efficiently in a welding shop than in our foundries. This was and is true of jigs and fixtures and certain other special items where only limited orders are called for. By 1937 this department contained all the machinery then available for efficient fabrication in small-lot quantities: Brakes, shears, bending rolls, speed saws, manipulators, multi-torch pantographs and the best obtainable acetylene and electrical welding equipment, including butt welding and spot welding machines. The shop was placed in charge of a man whose engineering society papers on welding subjects are heard with respect.

We were so well pleased with the relative cost of single-lot welded items that we began to develop fabricating costs on any production items that were giving trouble in our foundries. Whenever we made comparisons of this kind, we were not satisfied alone with data from our own fabricating department; we sent the drawing to outside firms who had won a reputation for ingenuity in design and efficiency in the production of welded structures. We gave these firms the privilege of modifying our designs to give maximum economy when produced in welded steel.

This practice had been a policy with us for five years preceding our entry into the war. By that time the cost pattern to be expected from

. . FIG. 1—Block and base assembly of 1000-hp. diesel engine.

	Meehanite	Welded
Finished weight, lb.	10,620	11,442
Prod. rate per mo.	4	20
Finished cost	$1774	$6875



Meehanite

Welded

Welded Structures

By L. F. WILLIAMS
Assistant Secretary, Cooper-Bessemer Corp.
Mt. Vernon, Ohio

. . . In the manufacture of diesel engine components from welded steel fabricated both within and without its own shops, this company has been able to compare factory costs with those of comparable parts machined from Meehanite castings and has found them very much in favor of castings when production runs are moderate.

such comparisons had bcome rather clear. Even on intricate water-jacketed diesel engine or compressor parts with long, thin cores on which our foundry scrappage had run quite high at times, the best costs on the finish machined weldments still proved to be nearly twice casting costs.

We knew all this before the war, but we didn't wholly believe it. We had been so deeply impressed by Welding Society publicity that we still thought the cost of our welded structures was high relative to castings because we weren't smart enough in design or efficient enough in manufacture.

Navy Calls for Steel Design

Then came the war. We offered diesel engines cast of Meehanite metal to the U. S. Navy for service aboard fighting ships. However, as a result of British experiences with iron engines under the terrific force of the new explosives the Germans were using, our Navy Department insisted upon welded steel. *Since then, war experience has indicated* that diesels of cast Meehanite could readily be designed to eliminate the objections raised and, in fact, to offer certain distinct advantages. But the war was on, and the decision had to be postponed.

The decision to use only diesels of welded steel aboard fighting ships created a production problem for us which we choose to regard as an opportunity. Instead of expanding our welding facilities, we decided to sell the output of our foundries to other manufacturers and buy outside the weldments we could not produce in our own shops.

We then approached the Navy and asked them to recommend the men whom they regarded as the best designers of welded structures in the United States. With their counsel we designed our engines for the Navy.

Next, we asked the Navy to recommend the fabricators whom they regarded as the most efficient and satisfactory in the whole country. Orders were finally placed with two of these firms. Later more were added, until our purchase of weldments was running into millions of dollars annually.

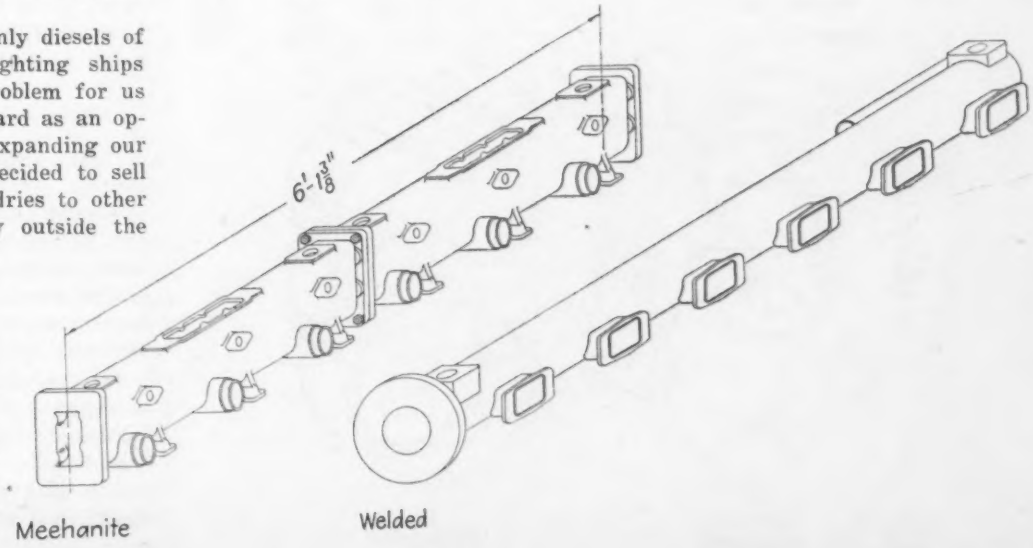
In the following comparisons we give the lowest costs we have been able to get on any of the structures illustrated whether from our own shops or from outside sources.

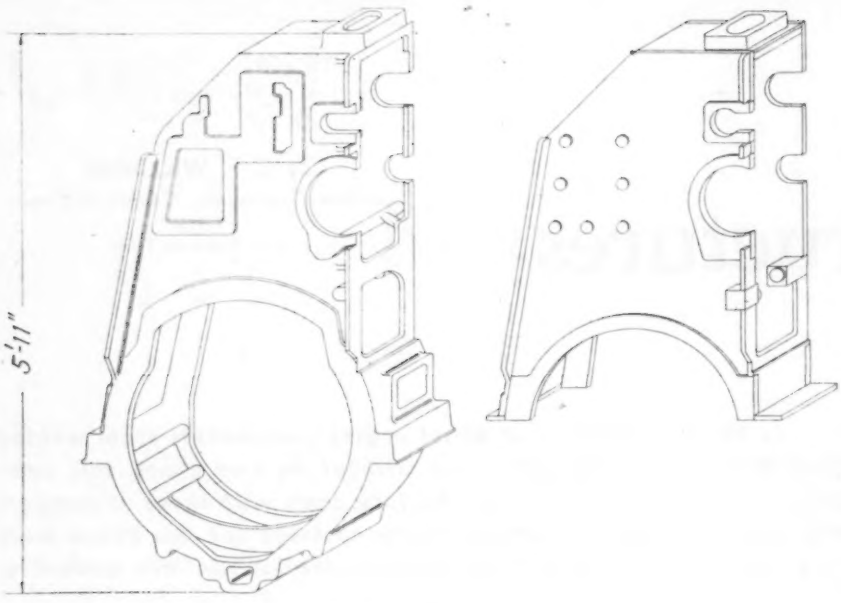
Casting vs. Weldments

In this connection it should be pointed out that the Cooper-Bessemer Corp. operates on a standard cost system which is constantly being revised in the light of actual costs. In the examples that follow it will be found that production quantities vary from four to 20 units a month and that most of the jobs, particularly the cast units, have been running over a period of several years. Hence pattern costs on the one hand and welding fixture costs on the other hand appear in the cost figures only as a part of overhead distribution. Pattern and core box costs are absorbed as a part of foundry overhead and are charged at a flat rate per direct molding and core hour. Welding jig and fixture costs are handled somewhat differently, being considered as a part of all factory jig and fixture expense

. . FIG. 2—Diesel exhaust manifold.

	Meehanite	Welded
Finished weight, lb.	442	222
Prod. rate per mo.	4	10
Finished cost	$180	$345





. . FIG. 3—Auxiliary drive housing for 1000-hp. diesel engine.

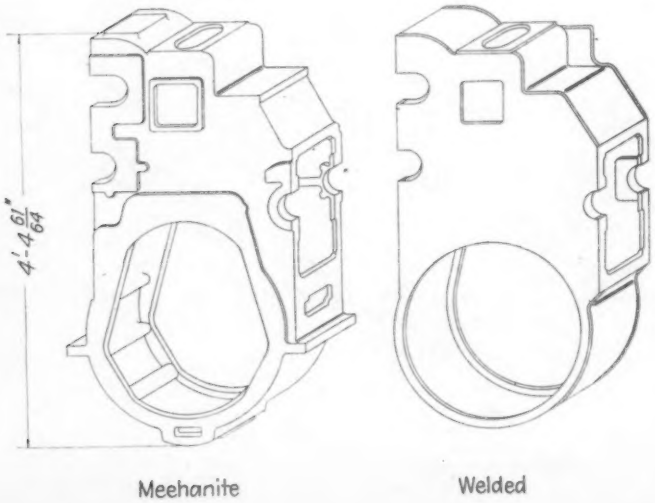
	Meehanite	Welded
Finished weight, lb.	738	361
Prod. rate per mo.	4	20
Finished cost	$200	$385
Direct labor, man hours		
Fdry. or weldery	8.98	34.59
Machine shop	36.00	46.63
Total time	44.98	78.22

and distributed as a part of general overhead on the basis of direct labor hours.

Some of the factors affecting the marked differences in cost have to do with the before and after treatments of weldments. Many of these composite structures employ steel castings and forgings in conjunction with rolled plates and shapes. The premachining of these pieces is a big item, not to forget the pattern and die costs which must be absorbed. Flame cut parts call for a template, and the welding fixtures themselves require storage space like corresponding patterns. Most weldments are stress relieved in a furnace after fabrication and in marine applications special finishes like galvanizing or Heresite enamel are called for. However, the heat-treating costs have not been included in these cost analyses.

. . FIG. 4—Chain drive housing for 600-hp. diesel.

	Meehanite	Welded
Finished weight, lb.	287	295
Prod. rate per mo.	4	10
Finished cost	$200	$460
Direct labor, man hours		
Fdry. or weldery	7.45	32.45
Machine shop	36.20	50.00
Total	43.65	82.45



The isometric drawings, Fig. 1, show the construction required for a 1000-hp. diesel engine assembly in both cast Meehanite metal and in welded steel. In the latter case the base, block and intake manifold are fabricated separately. Using Meehanite it is possible for the manifold to be cast integral with the block, which partly accounts for a surprisingly wide variance in finished cost. The finished cost in welded steel, although based on a production rate of 20 per month, is $5100.50 more per assembly than for the Meehanite assembly produced at the rate of four a month.

Although the block and base weldments were produced by an outside manufacturer and machined in our own plant, generous allowances made for the other manufacturer's profits still do not affect the comparison materially. This comparison was so astonishing that we had all the factors checked by three different groups in our organization: Engineering, cost, and manufacturing. Thus we were pretty well convinced that in moderate repetitive production, complex welded structures of this type could not compete in cost with cast Meehanite structures. We traced this conclusion, however, through other comparisons.

The second case studied was of a 600-hp. diesel block and base assembly similar to the unit shown in Fig. 1 except that it has six cylinders in place of eight. In making comparative cost studies we were looking for unbiased facts to guide our decisions on postwar designs. Based on an output of four blocks per month the finished Meehanite assembly cost is $1204 and the weight is 3375 lb. In welded steel, based on a production rate of 10 units a month, the cost is $3579 and the weight, 3340 lb. Here again the engineering decisions regarding the items to be included for a fair comparison of the two structures were as exact as we knew how to make them.

Relatively Simple Structures

Next costs were assembled on simpler structures to test the effect of design simplicity on the relative cost of weldments in moderate repetitive production. In each of the following examples the isometric drawings and accompanying figures are virtually self-explanatory.

In the case of a diesel exhaust manifold over 6 ft. long, Fig. 2, the weldment enjoys the advantage of considerable weight reduction over the casting as the finished weights are 222 and 442 lb. respectively. However, based on producing 10 weld-

ments per month, the finished cost amounts to almost double that for the castings based on only four per month. Both parts were produced complete by Cooper-Bessemer.

The drawings in Fig. 3 show cast and welded auxiliary drive housings for a 1000-hp. diesel. The welded steel part is little more than two-thirds the size of the Meehanite casting, because the base plate of the engine is used in place of the bottom third. Naturally the weldment is found to be considerably lighter in weight; but in spite of the difference in size, four of the Meehanite castings per month were produced at a finished unit cost of $185 less than the cost of the finished weldment based on 20 per month. In this case the weldment has been made and machined both in and outside our own shops.

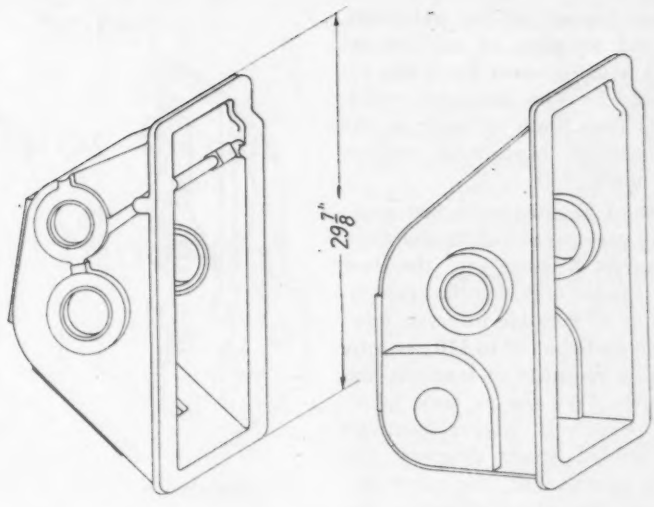
Where these differences in costs are centered can best be seen in the breakdown of direct labor manhours for both products. Time spent in preparation and welding is over four times as much as the molding, core making and cupola time expended in the foundry. Preparations for welding includes touch cutting, shearing, bending and forming operations plus time of assembling the pieces in the welding fixture. It should also be remembered that weld footage deposited is considerable, even in a simple structure like this.

Machining Time Shortened

Another factor is the increased time of machining steel vs. high test cast iron even though the differential in cutting speeds is being reduced by the application of cemented carbide tipped tools. For the part shown in Fig. 3, this difference is 30 per cent.

The cast and welded designs for the chain drive housing of a 600-hp. diesel, Fig. 4, are almost identical dimensionally, so weight and cost ratios more nearly represent the trend of our average experience than in the preceding comparison. The Meehanite and welded structures compare closely in weight but the finished cost of the cast Meehanite unit based on a production rate of four per month, is less than half the cost of the weldment made at 2½ times the production rate. Here again the weldment has been made and machined both in and outside our own shops. Note that machining hours are 40 per cent more for the weldment.

The structure indicated by the drawings in Fig. 5 showing auxiliary drive housing knees for a 1000-hp. diesel, are quite simple. However, the finished cost per pound is high because of extremely exacting machining and boring as well as some fancy



. . FIG. 5—Auxiliary drive housing knee for 1000-hp. diesel.

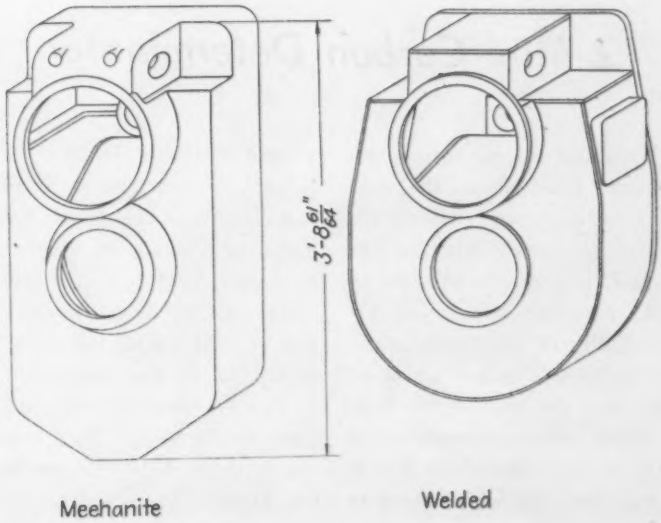
	Meehanite	Welded
Finished weight, lb.	122	121
Prod. rate per mo.	4	20
Finished cost	$70	$125
Direct labor, man hours		
Fdry. or weldery	2.80	12.60
Machine shop	15.90	15.65
Total	18.70	28.25

deep drilling for oil passages. The weldment, like the casting, was made and machined in our own shops. It should be noted that the machining time for the weldment is slightly less than for the casting in this instance.

The cast and weld versions of a turning gear housing for a 1000-hp. diesel are indicated by the drawings shown in Fig. 6. The change in form in the steel structure resulted in a slight increase in weight compared to the casting. Both parts perform the same service on engines of identical bore. Here again the cost per pound of the finished parts is inordinately high, but that is equally true of both types of structure. In fact, the comparison is more than fair to the welded structure as is evidenced by the relative production rates. The finished cost of the cast Meehanite structure is almost one-third that of the steel weldment. Both were made and machined in our own shops. The machining time is almost

. . FIG. 6—Turning gear housing for 1000-hp. diesel.

	Meehanite	Welded
Finished weight, lb.	104	110
Prod. rate per mo.	4	20
Finished cost	$100	$290
Direct labor, man hours		
Fdry. or weldery	5.10	42.00
Machine shop	13.85	20.50
Total	18.95	62.50



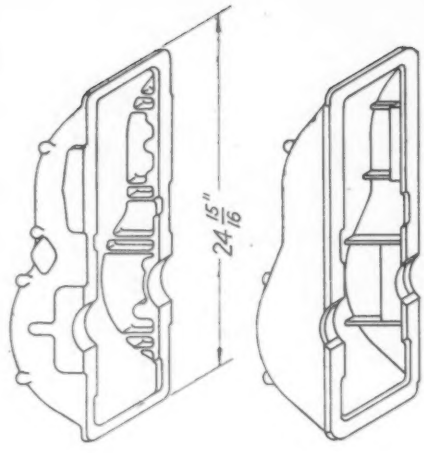
50 per cent higher for the weldment.

Last, and simplest of all the designs, is a housing cover for a 600-hp. diesel, Fig. 7. The machined weldment costs four times as much as the finished casting. Machining time is twice as much.

The cost of finished-machined parts is the only cost presented in the foregoing figures because, in the last analysis, it is the only one that counts. As a matter of possible interest, however, we do find that 30 to 110 per cent more time is required to machine the welded parts. We see no way to reduce the relatively higher machine time on welded steel. Anyway the problem is approached, the same machinery and the same attention devoted to Meehanite castings will maintain that adverse ratio.

It has been suggested in the foregoing comparisons that greater design ingenuity might reduce the cost of the weldments shown. That statement is equally true for any of the castings. As a matter of fact, some of the most valuable production ecomies effected in our company have risen from close cooperation between the engineering department and the foundry, directed toward increased economy in casting design. The inclusion of the intake manifold as an integral part of the cylinder block casting is a minor example.

Another point meriting a word of discussion is the relative weight of castings and weldments, as shown in the examples cited. While it is true that we did employ the best welding consultants obtainable, the position was taken that this was no time to take chances by designing for maximum lightness. This conservatism



. . FIG. 7—Housing cover for 600-hp. diesel.

	Meehanite	Welded
Finished weight, lb.	42	46
Prod. rate per mo.	4	10
Finished cost	$15	$62
Direct labor, man hours		
Fdry. or weldery	1.22	11.15
Machine shop	1.93	4.00
Total	3.15	15.15

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was based on the number of failures with welded frames recently experienced by some other diesel engine builders. All the weldments illustrated are probably somewhat heavier than they need be, and some reduction in cost would no doubt accompany a reduction in weight. Such reductions are not of sufficient magnitude, however, to affect the preceding cost comparison materially.

The failures of welded steel frames mentioned above were numerous and ruinously expensive. They serve to remind us that a complex weldment is as hazardous to produce as a complex casting.

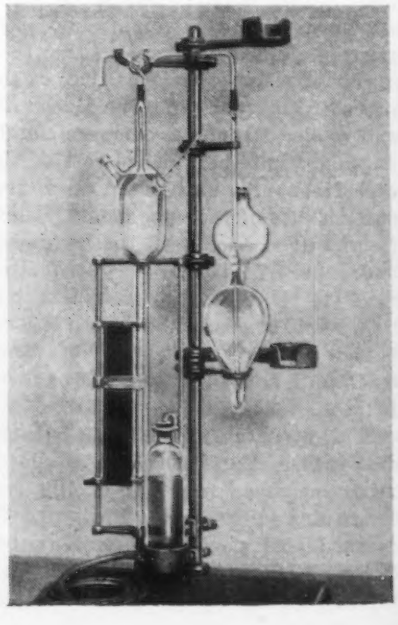
Mention has also been made of our Navy's predilection for diesels of welded steel aboard fighting ships. It was the only attitude that could have been safely adopted in the light of information then available. Recently, we were privileged to meet with a leading authority on British naval affairs. He had inspected a large number of ships which had been bombed and mined. His findings confirmed our initial opinions. Steel weldments, while they do not shatter, are usually thrown so completely out of line that they cannot even be salvaged. He was definitely of the opinion that we could safely return to the use of cast iron, providing we designed to avoid all overhanging pieces.

In general, this study reveals, upon quite accurate bases of comparison that in moderate repetitive production the cost of finished-machined diesel engine weldments is on the average 330 per cent more expensive than the cost of similar Meehanite castings. Sufficient weight and service advantages to offset this cost differential have failed to appear. Therefore weldments cannot sensibly be considered as a postwar competitor to Meehanite castings in our diesel engine designs.

In moderate repetitive production what is true of diesel engine construction is apparently true for most heavy machinery built on a comparable scale of output. We have checked our experience with that of eleven other heavy machinery builders and find that in their case the cost of weldments usually exceeds the cost of castings by 200 to 250 per cent.

2-Min. Carbon Determinator

IN the improved 2-min. carbon determinator illustrated, the gas pressure in both the measuring burette and the carbon dioxide absorption vessel is precisely brought to atmospheric pressure, thus eliminating the possibility of inaccurate reading due to difference in gas pressure at the start and the end of the test. The absorption vessel is constructed in the form of a U-tube which has a capillary tube stem on which there is a fixed hairline marker. This marker is set at atmospheric pressure level and eliminates the error usually introduced in leveling by eye between the aspirator bottle and burette stem. With this carbon determinator, which can be used for all metals, the sample is burned in the combustion tube in a partial vacuum, thus aiding complete combustion. This apparatus is the product of the Harry W. Dietert Co., Detroit.



Safety Color Code For Industry

TO indicate accident hazards, identify protective equipment and assure orderly factory arrangement and good housekeeping, a uniform system of color signals for industry is proposed by the finishes division of E. I. du Pont de Nemours & Co. While color is frequently used for safety, many of its applications are inconsistent and confusing. One factory, for instance, has its machine guards painted red, which would indicate that the very safety device itself is dangerous. Such promiscuous use of color defeats its own purpose, du Pont engineers point out.

Color in a safety program should attract the worker's attention and call forth common associations. The association of red with fire and green with safety, for instance, is traditional. The factor of high visability under all lighting conditions must also be recognized.

Six colors are recommended by du Pont as basic for a general industrial safety color code, namely: Yellow, orange, green, red, blue and white (including black and gray). These colors and their application are defined as follows:

High Visibility Yellow should be used to mark strike-against, stumbling, falling or tripping hazards. Where unusually strong attention value is necessary, parallel bars of black and yellow should be used since this combination has the highest visibility of all. Typical applications are:

Trucking equipment
Aisle markings around hazards
Edges of loading platforms and pits
Railings
Floor pan edges
Conveyor parts at hazardous levels

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Aisle obstructions
Protruding parts
Curbings
Dead ends
Low beams
Stairway approaches
Floor elevation changes
Chain hoist blocks
Loading buckets

Alert Orange is the loudest color in the whole code. It should be used to indicate dangerous parts of equipment that might cut, crush or otherwise injure a worker. If machine guards are removable, the inside part should be painted with orange to attract attention to the hazard (see illustration). In general this color should be applied to:

Interior surfaces of:
- Electrical switch boxes
- Fuse boxes
- Power boxes
- Machinery guards

Exposed parts:
- Pulleys
- Gears
- Cutting devices
- Rollers

Safety Green has always been associated with safety and medical practice. Use of a green cross painted on the wall can be used to identify the location of cabinets for gas masks, respirators, medical supplies and stretchers.

Similarly, the association of **Fire Protection Red** is well established. Applied on walls, posts and floors it serves to spot fire protection equipment like extinguishers, hydrants, alarm stations and fire blankets.

Blue has been used for many years to indicate caution. Blue signs have been used by the railroads to warn against moving a car or train while it is being worked on. Hence in industry, the chief function of **Precaution Blue** is to caution against the operation of equipment which is down for repair or which should not be moved or started without an investigation. A blue disk should be hung over such devices and the employee instructed accordingly.

Traffic White and its complementary color of black or gray should be used for marking aisles, storage space and rubbish containers and the space immediately surrounding them. For traffic control, the rule is to use white on dark floors and black on light floors.

The application of the color code system ties in with the concept of "three dimensional seeing," another du Pont development. In this system of painting machinery for maximum safety, the bodies of machines are painted horizon gray and the working areas in a contrasting light tone, such as spotlight buff or light green. Walls, ceilings and floors are also painted in colors high in reflective value.

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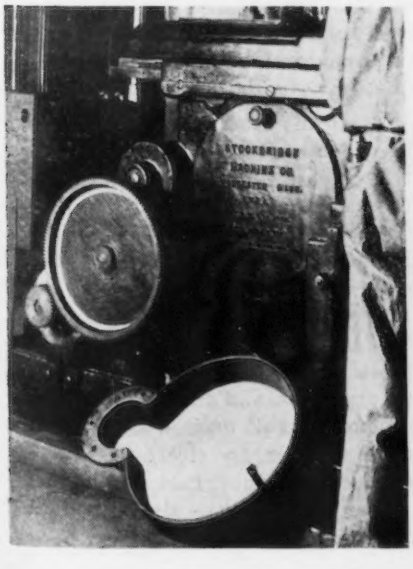
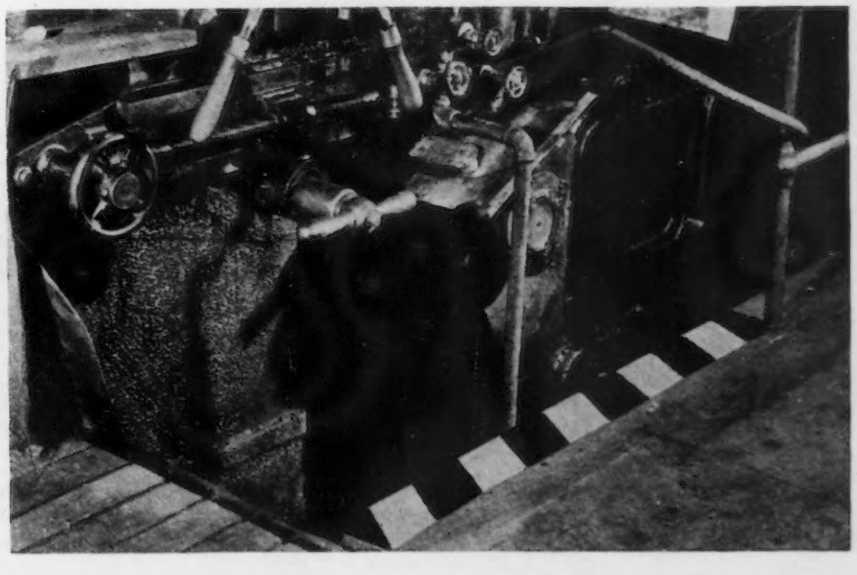
ALERT Orange serves functionally to advantage when painted on the inside of removable machine guards. This calls attention to the fact that protective equipment has been removed and that extreme hazard is present until guard is replaced.



YELLOW has the highest visibility under practically all lighting conditions. This unguarded open pit presents an excellent opportunity for high visibility yellow to play the role assigned it in the safety color code.

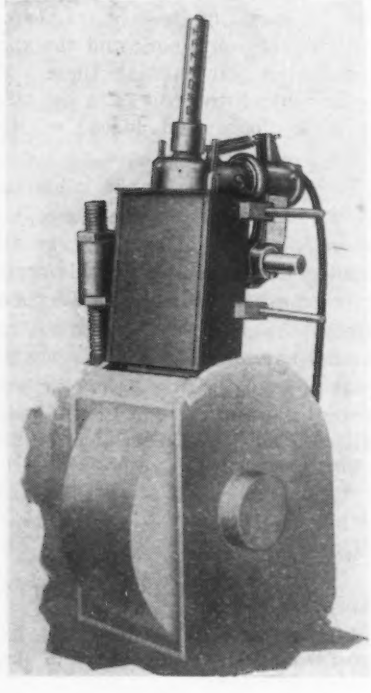


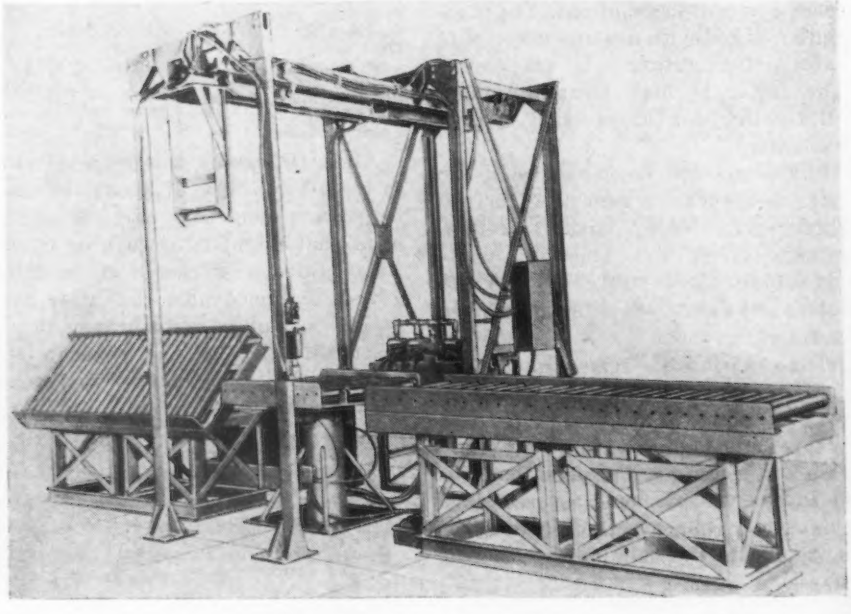
New Equipment . . .

Finishing

. . . Herein are described some new developments in pickling bath accessories, heating tanks, cleaning processes and solutions and corrosion control material.

AN automatic composition applicator for use on polishing and buffing machines has been announced by *Hammond Machinery Builders, Inc.*, 1612 Douglas Avenue, Kalamazoo, Mich. Known as the "Auto-Doper," it can be used for either cylindrical or rectangular bars. It is operated by compressed air and the frequency of operation is controlled by an air valve operated from a cam, electrical timer or foot valve as the requirements may indicate.





Pickle Bath Feeder

AN automatic hydraulic elevating turn table with a ram unloader and two auxiliary tilting conveyor tables has been developed by the *Lyon-Raymond Corp.*, 1442 Madison Street, Greene, N. Y., for automatically feeding processed parts to a pickling bath. The table elevates hydraulically 38 in. and at the same time turns 90 deg. A pusher automatically travels across the table and pushes the basket onto another roller conveyor and then into the pickling bath. The pusher returns to its original position and the table lowers and turns 90 deg. back to its starting position. These operations are all hydraulic, controlled by limit switches and solenoid-operated hydraulic valves.

Aromatic Solvent

AN alkyl aromatic solvent concentrate which is said to be nonflammable and non-combustible has been put on the market by the *Curran Corp.*, Dowling Building, Malden, Mass. Aqueous solutions are stated to be completely stable at elevated temperatures and inhibit rusting of parts cleaned.

Chromium Process

A PROCESS of electroplating with trivalent chromium has been developed by the *Warner Laboratories*, 360 North Michigan Avenue, Chicago. Skalite chromium salt is claimed to provide substantially greater plating efficiency. Due to the bath's non-gassing characteristics and substantially increased throwing power, there is no need for special contour anodes on intricate objects. The bath is non-corrosive and non-poisonous. Skalite is said to require only one-fifth as much salt, time and electrical energy as when chromic trioxide is used.

Emulsion Cleaner Concentrate

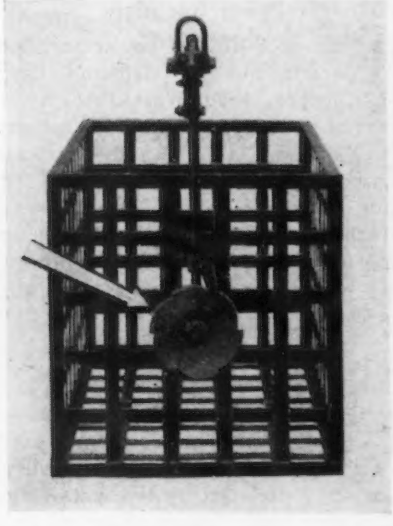
A CONCENTRATE type emulsion cleaner comprising soaps, blending agents and co-solvents for industrial grease cleaning applications has been developed by the *Pennsylvania Salt Mfg. Co.*, 1000 Widener Bldg., Philadelphia 7. Pennsalt EC No. 2 may be diluted with from 5 to 20 parts of solvents such as kerosene, Stoddard solvent or light fuel oil distillate for removing carbonized oils, grease, smut, and drawing and buffing compositions. It may be used as a precleaner prior to electroplating and also acts to inhibit rust formation.

The company has also developed a solvent emulsion cleaner which com-

bines soap emulsifying action with solvent penetration. Undiluted Pennsalt E.C. No. 10 may be applied cold by dipping, spraying or brushing. It is of the emulsifying, non-phenolic type and is for use in removing grease, oil, smut, and drawing compositions from metals and painted surfaces.

Pickling Basket

A SIMPLIFIED ratchet which holds a pickling basket in six different positions for draining has been introduced by the *Youngstown Welding & Engineering Co.*, 3800



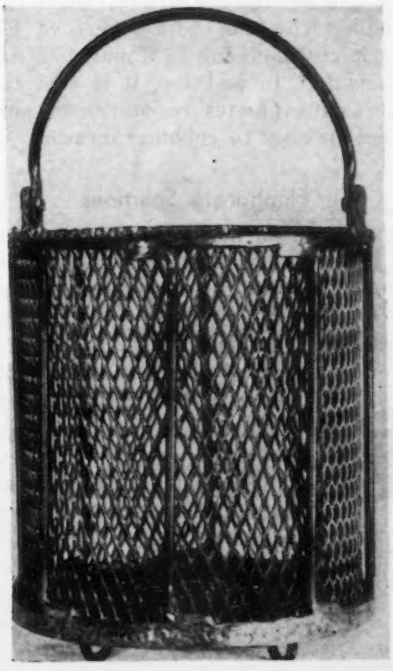
West Oakwood, Youngstown, Ohio. It is strong enough to be applied to practically any size equipment. The ratchet pictured is on a Weldco crate 60 x 32 x 33 in. and carries a 3000-lb. load.

Cleaning Process

DIPPING or spraying Magnafluxed parts with Cyclodiene hydrocarbon solvent removes oil and dye and leaves clean metal surfaces, according to *Colonial Alloys Co.*, Colonial Philadelphia Building, Philadelphia. It can be handled in ordinary open tanks or spray machines at room temperatures. Toxicity is said to be negligible, and the solution may be used over and over again. Magnafluxed parts thus cleaned are ready for such surface finishing as rust proofing, painting or other organic or chemical finishing, electroplating or anodizing.

Processing Baskets

PROCESSING baskets of all-welded construction have been put on the market by the *Hoffman Co.*, 4143 North Penn Street, York, Pa. They



are available in any size rod, of perforated or expanded metal or woven wire, with heavy round rod frames. Made in either plain or stainless steel, Monel or other metal, construction is all welded.

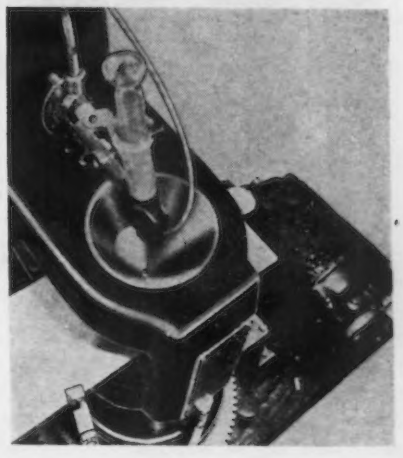
Portable Heating Tank

A PORTABLE heating and dipping tank, which includes an acid compartment, has been developed by the *Heil Engineering Co.*, 12901 Elmwood Avenue, Cleveland. The tank is divided into three compartments for degreasing, rinsing and pickling. A dual-purpose cover and shelf is acid proofed and arranged to drain into the tank. The first compartment is

furnished with a standard heating unit for hot alkaline degreasing compounds; the second for cold rinsing, and the third is lined with Plast-O-Ply, an acid-resistant coating suitable for pickling acids such as sulphuric, muriatic, phosphoric, hydrofluoric and oxalic, in dilute solutions.

Coating Testing Machine

TWO new machines for controlled testing, measurement and evaluation of the flexibility, scratch hardness and adhesion of paints and other coatings, have been developed by the *Arco Co.*, Bessemer and Clarke Streets, Cleveland. Tests and measurements of flexibility are made on the Elongauge, a conventional Erichsen sheet metal testing machine adapted to provide complete automatic controls and accurate measurements for cycle testing. Scratch hardness and adhesion are measured by the Microknife. A diamond point cutting tool is applied to the surface



being tested by a lever arrangement carrying beam and weight. The load, measured in grams, is applied to the point which moves across the surface at a constant speed and cuts repeatedly in a fixed position until the subsurface is revealed.

Anti-Corrosion Films

ANTI-CORROSION films for steel can be obtained by the use of Sublan, according to *Glyco Products Co., Inc.*, 26 Court Street, Brooklyn 2. Diluted with an equal amount of thin, acid-free mineral oil, Sublan may be applied to highly polished steel surfaces or polished panels. The coating is said to withstand hydrobromic acid and salt water immersion and humidity tests conducted in accordance with Government specifications AXS 674. It is readily removed from the surface by cold solvent wash or dip.

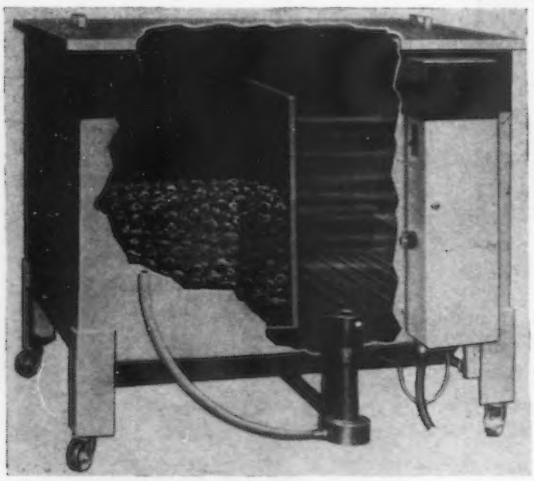
Gold Plating Process

AN industrial gold finish that can be applied quickly and economically has been developed by the *Alrose Chemical Co.*, Cranston, R. I. The Trushade process consists of suspending 24-kt. metallic gold in an aqueous medium for use in preparing

24 kt. and alloy plating solutions. Hard and 14-kt. alloys are also suspended in an aqueous medium and used in conjunction with 24-kt. gold in preparing alloy plating solutions. Tests are said to show acid resistance up to 3 hr. on a 70 sec. application.

Degreasing Unit

AN addition to the line of degreasing equipment offered by the *Phillips Mfg. Co.*, 3477 Touhy Avenue, Chicago, is a degreasing unit to



include a pre-dip wash and vapor rinse and dry in an open-top manual, portable degreasing unit. The pre-dip wash consists of a kerosene-solvent solution, to which is added a wetting agent, which is said to have the quality of thoroughly wetting down the oils, greases and waxes, and emulsifying or saponifying them to a great enough extent to permit the solution to thoroughly flush them off the parts before they are placed in the vapor compartment where they are rinsed and dried.

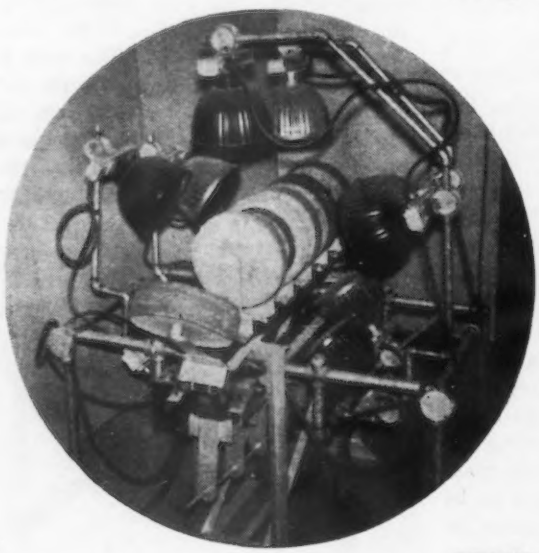
Shear-Hardness Finish Tester

ANNOUNCEMENT of a shear-hardness attachment for its abraser has been made by the *Taber Instrument Corp.*, North Tonawanda, New York, for measuring the toughness quality of surface finishes and their ability to resist digs, scrapes and similar abuse. A weight slides along the calibrated beam until it is located in the position where the correct load permits the tool point to cut a groove in the surface finish without digging through to the base plate. Several grooves are made and one is selected to measure to the nearest thousandth of an inch. The shear-hardness of the specimen is calculated by taking the reading from calibrated beam at the forward edge of the adjustable weight, which together with the width of groove, determines the result by a mathematical formula. In addition, it is said the abraser evaluates resistance of surface finishes to rubbing abrasion.

Fluoborate Solutions

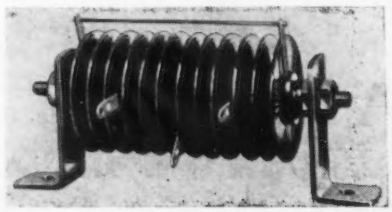
TWO lead fluoborate solutions for use in lead electroplating are being offered by the *Pennsylvania Salt Mfg. Co.*, 1000 Widener Bldg., Philadelphia 7. Pennsalt LF 42 and LF 50 are available in 42 and 50 per cent Pb $(BF_4)_2$ concentrations and are stabilized with excess fluoboric (HBF_4) and boric (H_3BO_3) acids in balanced percentages. For use, they are diluted with water to the desired concentration.

Also being offered is fluoboric acid (BHF_4), which is a 42 per cent solution containing a slight excess of boric acid for stabilization. It is a clear, colorless solution having a specific gravity of 1.33. Its suggested uses are in the control of acidity in fluoborate electroplating baths, preparation of various metallic fluoborates, pickling agent and preparation of catalysts.



Infra-Red Dryer

THE infra-red lamp polishing wheel drying machine introduced by *J. J. Siefen Co.*, 5657 Lauderdale Avenue, Detroit, has two speeds so wheels can be dried faster when only one head is on wheels and slower when 2 or 3 heads are put on the wheels, or for small diameter wheels which can be dried faster. The fully-enclosed 1000-watt lamps are held in adjustable holders. They require 220 volts single phase inasmuch as two 110-volt lamps are hooked up in series. The driving motor operates on 110-volt lighting circuit. The average drying time is said to be 10 min., plus 5 min. for cooling wheel.



Power Rectifiers

THE Selco line of power rectifiers is announced by *Selenium Corp. of America*, 1800 West Pico Boulevard, Los Angeles 6, in sizes ranging from ¾ to 4½ in. in diameter. Assemblies with output up to 1000 amp. can be supplied. Rectifiers are of the selenium type and are available for bolt or stub mounting direct to equipment or with mounting brackets.

Electrolytic Finishing

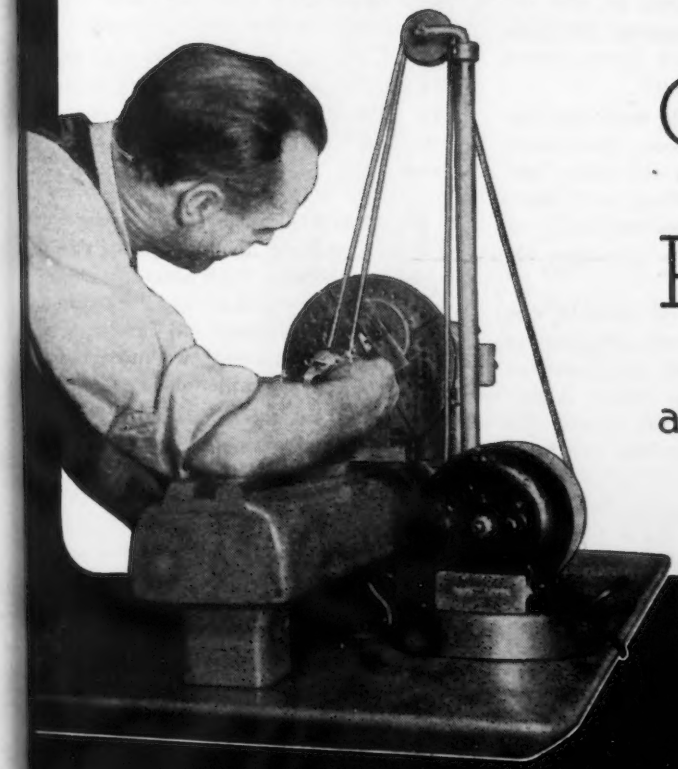
EXCELLENT results are said to have been obtained from a process of electrolytic cleaning of silver castings developed by the metallurgical laboratories of *Sam Tour & Co.*, 65 Pine Street, New York. A suitable solution is prepared and held at the correct working pressure. The casting to be cleaned is used as an anode and a selected metal for the cathode. The silver removed in the operation plates out on the cathode and is all recovered. Film is completely eliminated and a clean, bright surface is obtained.

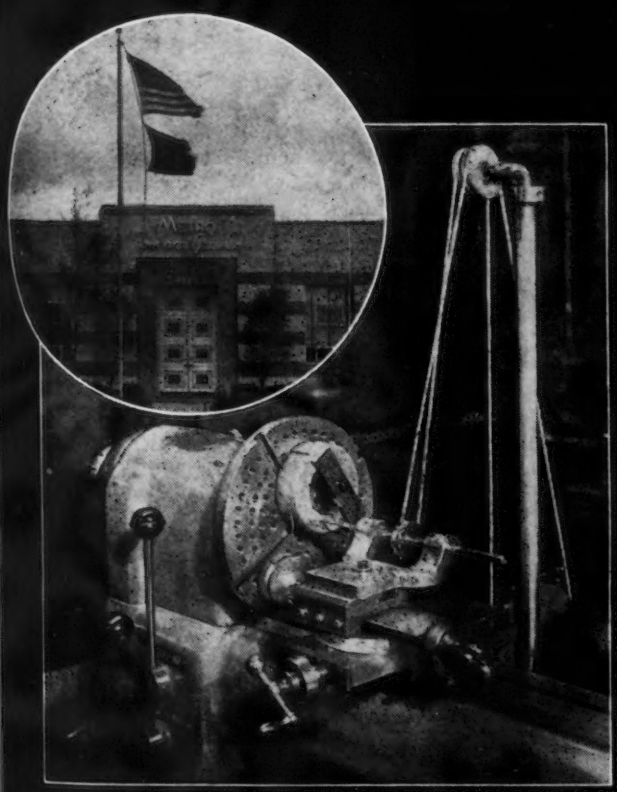
Synthetic Shellac

THE development of synthetic shellac has been announced by *Arthur D. Little, Inc.*, 30 Memorial Drive, Cambridge 42. It is said to have more adhesion to metal as well as wood and subsequent resistance to water than the natural product. The product is being marketed under the name Zinlac and is being used in shipbuilding, life rafts, communications, gas masks, fuses and other military products.

HARDINGE Precision Lathe Grinding a Precision Gage

at Metro Tool and Gage Co. Chicago, Illinois





The HARDINGE High Speed Precision Lathe is being installed in ever increasing numbers in tool and die shops in the United States and Canada because they are well suited to a wide variety of work involving the precision limits in modern manufacturing.

The sustained accuracy of the HARDINGE High Speed Precision Lathe means dependability in operation.

Write for 16 page bulletin describing this machine and other Hardinge Precision Products.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR

HARDINGE
ELMIRA, N.Y.

Assembly Line . . . STANLEY H. BRAMS

• Strikes by foremen bring a reaction from the Automotive Council while the union reaches an agreement with Ford expected to avert tie-ups . . . Worker walk-out at Ford of Canada settled.

DETROIT—The most important news from this area is still out of the labor sector. Last week saw the strike of the Foreman's Association of America in 14 plants of six companies continuing, while across the river, in Windsor, the tieup of Canadian Ford plants arrived at an anticlimactic end.

The problem of foreman unionization split the automobile management front. Ford Motor Co. signed an unprecedented bargaining contract with the FAA almost at the same moment the Automotive Council for War Production hatched a frontal attack on the supervisors' group through publicity and paid newspaper advertising. Meanwhile, the National War Labor Board modified its previous stand, reporting that although foremen still could not bring their bargaining problems to the board, they were entitled to the board's protection against any violations of the Wagner Act.

Ford's contract with the FAA signed "with the hope that it will produce better relations," set up a well defined grievance procedure between company and union.

Any disputes between a supervisor and the company will be referred to the union's building representative for handling. Inability to settle at that level will move the discussion up to the union building chairman and company plant superintendent. Continued unsettlement at that point would result in the dispute's going to a labor-management committee representative of administrations on both sides.

A seniority arrangement was set up. Plans were developed to work out a schedule of sick leaves based on accumulated seniority.

No checkoff demands were ever involved in the discussions. The closed shop demand made by the union bargainers was denied. Wage and classification agreements reached last year were incorporated into the new arrangement.

With that agreement reached, the FAA hoped that the other plans on strike would follow suit, but that was not immediately in the cards. A day later the Auto Council loosed its scorching broadside against the foremen.

"On the eve of invasion—War production threatened by drive to unionize management," read the captions on the auto council advertising. The copy went on to ask: "What kind of collective bargaining is it when union leaders sit on both sides of the table? If management is to be unionized, where is union control to stop?"

This copy was prepared after a hurry-up meeting of the Council board. Henry Ford II, newly elected to that body, was absent, and has since refrained from comment. General automotive belief was that the stand of the Council was led by General Motors Corp., which has always been the foremost opponent of supervisory unionization in an industry rather solidly of that same viewpoint.

The FAA took a backhand slap at the Council position, remarking that it ill befitted a "union of 550 companies" to object to unionization elsewhere.

MEANWHILE, there was no sign of cracking among the struck companies—Briggs, with seven plants, Hudson with three, Murray, Packard, Gar Wood and Aeronautical Products. But there were at least two most interesting and significant developments.

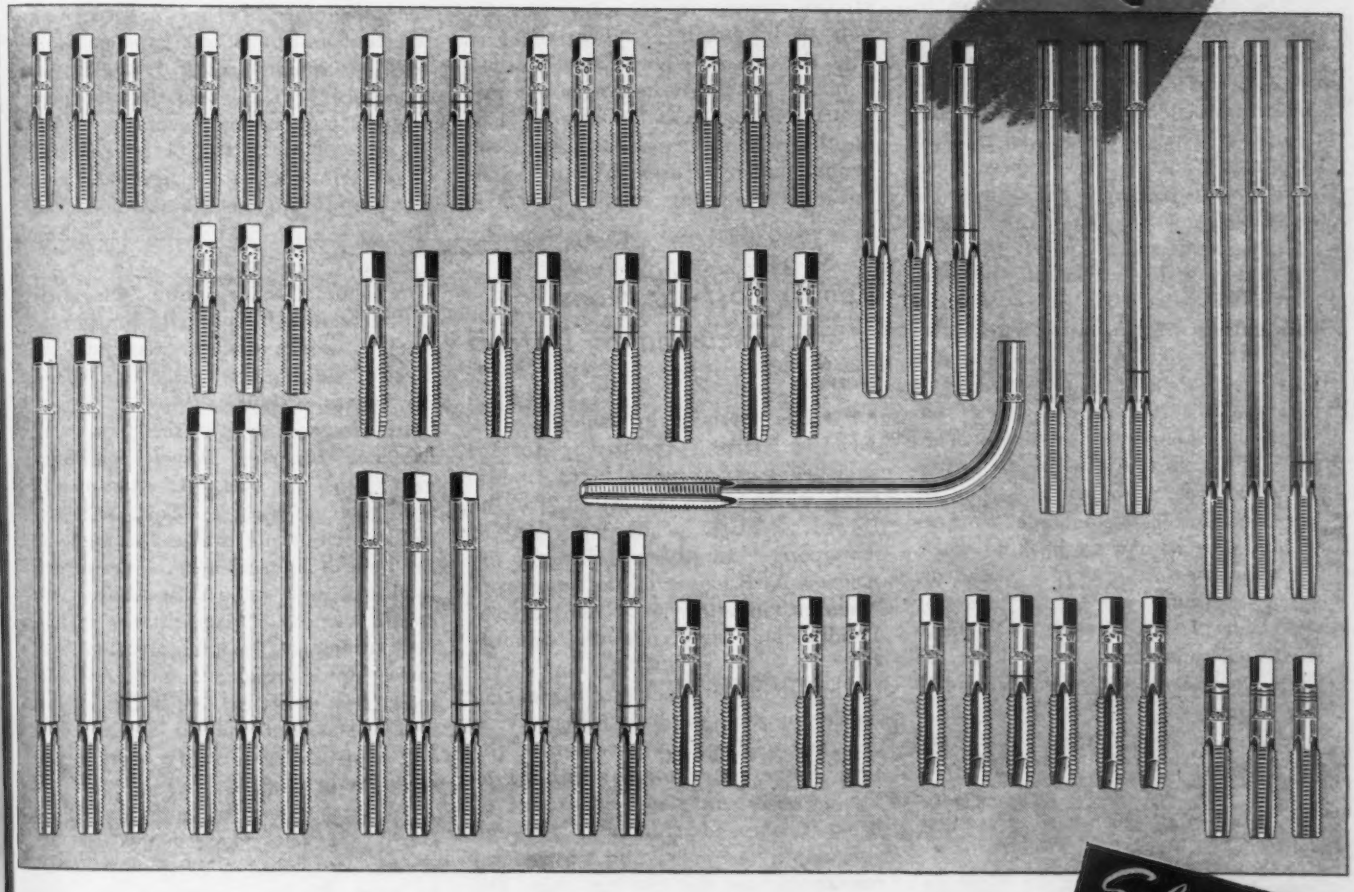
Production impairments common to all the struck plants reached the point at Packard where Army Air Force inspectors stepped in, said quality was being lowered to the refusal point in the absence of competent supervision. As a result, Packard closed down last Friday night.

At Aeronautical Products Co., the 59 striking foremen were declared discharged and replacements hired. No sooner had seven new foremen come onto the job, however, than the UAW-CIO rank and file workers struck in protest at that action.

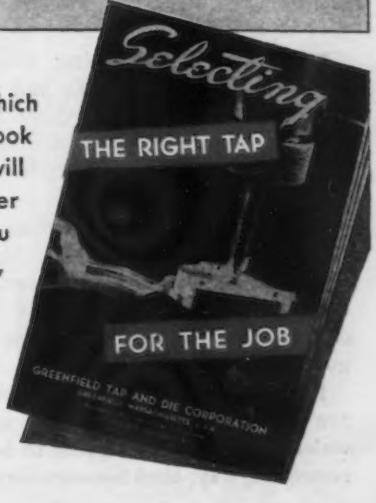
Deadlock thus prevailed as the week came to its end. The WLB had previously announced it had taken jurisdiction, but declared it would press no action while the strike con-

BELL HELICOPTER: *This two place cabin craft with a single two-bladed rotor and a conventional anti-torque propellor on the tail, was developed by the Bell Aircraft Corp., and has been undergoing trials for about a year. It is powered by a Franklin engine rated at 160 hp.*

I WANT A GREENFIELD TAP—
SIZE ½" — 13 N. C.
YES, SIR. GREENFIELD REGULARLY MAKES 61 KINDS IN THIS SIZE— WHICH WILL DO THE BEST JOB FOR YOU?



IT'S TRUE. Shown above are the 61 different kinds of ½"—13 N. C. Taps which "Greenfield" lists in its catalog, not including special "Maxi" finish taps. Many look identical, but each has its own particular qualities and usefulness. . . . Which one will do the best job for you? That is a "$64 question" that Greenfield helps you answer in its new booklet "Selecting the Right Tap for the Job." If you need more help, you can call on Greenfield's staff of expert screw thread engineers for recommendations, or ask a Greenfield field service engineer to call.



GTD GREENFIELD
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GREENFIELD TAP & DIE CORP.
GREENFIELD MASSACHUSETTS

tinued. The FAA then wired all struck companies, saying it would order its men back to work only after conferences with the managements. The reason given for this attitude was that WLB procedures are apt to be slow, and that the union wanted to be sure that no discrimination would prevail against strikers if they ended their walkouts. The action taken by the Aeronautical Products management was later cited as exemplary of the fears felt by the foremen. However, the companies refused to meet with the union; and the WLB refusal to mediate before the strikes ended provided another road block in a triangle of disclaimed responsibility.

The struck companies met an inquiry from WLB on the status of any men returning by wiring all foremen over last week-end summoning them back to work Monday morning. One company, Hudson, promised no discrimination against the strikers. However, picket lines on Monday morning dissuaded any of the strikers from going into the plants.

Ending of the strike at the Ford of Canada plants in Windsor came with rather a futile air. To recapitulate, this strike broke out in a dispute over grievance procedures. It was settled after several days' tenure, on the basis of a Dominion Wartime Labor Board promise to adjust the grievance procedure attacked by the CIO United Automobile Workers Union. The men went back to work, but after two days angrily withdrew again, claiming a "double cross by the War Labor Board." Feelings hardened, and the strike went on while Dominion arbitrators hurried to Windsor.

After this second strike had gone along for eight days, settlement was reached—on the same basis as before, that the grievance procedure would be adjusted!

THERE is something not only futile about a strike and settlement like this, but something stupid as well. Where the stupidity lay can probably be known only by the actual participants in the affair.

If government made promises after the first strike settlement that it would adjust the grievances satisfactorily, and then did as the union charged and made no change, then government was stupid.

If management was responsible for an unworkable grievance system which was ultimately going to be corrected anyway, then management was stupid if it let matters drift to strike stage before rectification.

If labor actually had a grievance over grievance procedure, got it settled after the first short tieup, then walked out for eight days in a strike extension whose only conclusion was a reiteration of the initial promises, then labor was stupid.

Stupidity is not an uncommon badge today, but it is poorly cast in these times when it becomes the villain who cunningly slips the wrench into the war production machinery, rather than the bystander who innocently lets it fall there.

Whether the same kind of futility and stupidity prevail in the foreman's strikes remain to be seen. But the pattern is certainly indicative of it. The three corner-holders in the triangle sit staring frowningly out into space. Government refuses to look at the other two until they clasp hands. Labor refuses to clasp hands until management makes the first move. Management refuses to make any move.

Naturally, all have apparently good reasons for their positions. Government doesn't want to set a precedent which may be bad. Labor doesn't want to take a chance on leaving its guard down. Management doesn't believe the foremen should have a guard up in the first place, on the grounds that the foremen are actually part of management.

But if all the reasons are good, there is no reason for this strike ever to end. Some one of the reasons is invalid, if not two or all three of them. And if invalidity exists, it should be recognized as such at the earliest moment. Should it lie in the corner of government, then management and labor alike and probably together should protest. Should it lie in either of the other two corners, a good government mediator should be able to make the erring member of the triangle see the light and even make a start down the sawdust trail.

Bendix Postwar Plans Discussed at Detroit

Detroit

• • • **The methods by which** Bendix Aviation Corp. is preparing for an enlarged postwar place in the industrial world were described to the Detroit Section of the Society of Automotive Engineers May 15 by Andrew A. Kuchner of the company's research laboratories, chairman of Bendix's long range planning committee.

This committee acts as a clearing house on new product ideas. It is designed to direct and coordinate the long range program, particularly as the program involves expansion of product lines. It functions through subcommittees consisting of general managers, and engineering, sales and manufacturing representatives.

Proposals are submitted to this committee by manufacturing divisions, outlining the name of the device, a description, function, specification, patent situation, unit cost and other engineering details. Sales histories and potential markets are described, as are manufacturing requirements.

Central planning committee members then file their reactions to such proposals, calling for additional detail as they may see necessary. Any approved material is finally submitted to the corporation's administrative committee for action. Of course actual work is necessarily limited because of continued war demands, but quite obviously this stage can be set for future activities.

Results of this procedure, Mr. Kuchner reported, have been most gratifying. He said, "As examples of new lines of future effort, substantial contributions are being made in the field of hydraulic valve actuation; hydraulic and pneumatic assists for a wide variety of applications including automotive; communication systems for railroads; commercial and industrial electrical controls; a new array of supplemental instruments and controls for aircraft, marine and commercial use.

"We are ready to take immediate steps to pursue vigorously these activities as soon as conditions permit," he said. "It has required the best part of a year to start getting our ducks in a row. There is no substitutes for these preliminaries to direct action."

Rust Gets Russian Order

Pittsburgh

• • • **Contract for** design and critical material for three furnaces for a rail and structural mill for Soviet Russia has been awarded to Rust Furnace Co., here. They will be continuous bloom heating furnaces with rated capacities of 60 tons per hr.

These are the Present
STANDARD SHAPES of CARBURS

INDUSTRY'S FIRST CEMENTED-CARBIDE ROTARY FILES

EACH of the tools illustrated is available in either four or five sizes—providing a range that meets almost any production requirement for deburring, filing or cutting. In addition to these, special shapes are being produced to meet the specific needs of many customers.

Since Carburs were first introduced, a number of performance reports have been received from the plants where they have been in constant use. These reports prove that these rotary files—which have teeth ground from the solid cemented-carbide—are providing up to 100 times greater life than high speed steel files. They are greatly reducing deburring, filing or cutting time per part because of the higher speeds at which they can be run and the less frequent need for replacement. Another important feature noted is that tool sharpening is reduced in proportion to the life of the tool.

You, too, will recognize these and other advantages once you have used Carburs in your production. Prompt delivery on all standard shapes and sizes can now be promised. Let us send you full information.

LINCOLN PARK—WHERE THE *"Impossible"* IN PRECISION IS ACHIEVED

ARMY E NAVY

LINCOLN PARK INDUSTRIES, INC.

Successor to The Lincoln Park Tool and Gage Company and Carbur, Inc.

1729 FERRIS AVENUE • LINCOLN PARK 25, MICHIGAN

Washington . . . L. W. MOFFETT

• Machine tool demands of armed services increased suddenly . . . Location and redistribution of government owned tools urged because of manpower problem.

WASHINGTON — Machine Tool Branch Chief A. N. Thomas has told advisory committee members that the machine tool demands of the armed services and other users have increased suddenly and sharply with the result that tentative estimates of requirements for the last three quarters may be in the neighborhood of $400,000,000.

Taking first quarter shipments of $150,000,000 and a backlog of $150,000,000, plus 1944 estimated requirements, it was shown that original Tool Division prediction that the value of production in 1944 would not fall below 60 per cent of the industry's $1,000,000,000 peak is proving accurate. Some government officials had expected the worth of 1944 tool output to fall to a mere $350,000,000. The stepped up demand is attributed to new programs like increased shell production and normal replacement requirements.

The Tool Division officials said that since manpower is a limiting factor, and many of the excellent subcontractors who worked with the industry have turned to other fields, the only solution to this situation is to locate and redistribute the many government-owned machine tools. A conflict was pointed out between machine tool industry official estimates of the number of idle tools (25,000 to 80,000) and the number that government surveys have been able to locate (8000 on the basis of incomplete returns).

TO determine the quantity of machine tools idle and available for transfer, all prime contractors having government owned tools in their plants are being required to report on form WPB-3475 all machine tools worth $500 or more which are not being used and which will not be used on war contracts within 30 days. Industry members expressed disbelief that only 8000 government-owned tools are idle.

The point was made that it is probable that many contractors are refraining from reporting idle tools with postwar business in vew. It was also noted that the services desire to maintain certain portions of their equipment for standby purposes. There was general agreement that it is a mistake to have so many different stocks of government owned machines, and one member urged that industry organizations give as much impetus as possible to the location of idle tools.

It is rumored about WPB that the armed services are becoming interested in locating idle tools, and if this is true, bets are being made that more tools will turn up than have heretofore.

TOOL Division Director John S. Chafee told the meeting that problems introduced by these new and unexpected demands are extremely serious, as the industry has never been in such an inflexible position as now. He said that the engineering department of many plants have been reduced by the draft to such a extent that production is geared down to their limited capacity; and added that the proportion of the machines which need special tooling is much greater than it was a year ago.

Mr. Chafee declared that the direct war contracts which the industry has accepted complicate and restrict utilization of the capacity which otherwise might be relied on. The full effect of the direct war work (manufacture of critical components) is not accurately known, although for example it is estimated that where the industry's turret lathe capacity was formerly 1500 machines a month, it is now only 400.

A survey of capacity devoted to discovering how much direct work the industry has accepted has been conducted, and a report will be available soon. Some machine tool companies took on gun mount contracts; others agree to produce valves when the drive was on to eliminate component bottlenecks. Now when components are no longer as tight as they once were, part of this capacity may be redirected to

TANK PARK: *Members of a U. S. tank division in Great Britain are shown preparing their tanks for extensive maneuvers. The dawn-to-dark activity around the tank parts is daily routine during these final hours before the invasion.*

TOOLS WORK TWO EXTRA SHIFTS PER WEEK

SUNOCO
EMULSIFYING CUTTING OIL

increases tool life 35% . . . improves finish . . . at war plant

Machine tool men looking for ways to effect tool economies will find this case history valuable. It's about a plant producing armament parts, and how they increased tool life the equivalent of two extra 8-hour shifts in every 48-hour week.

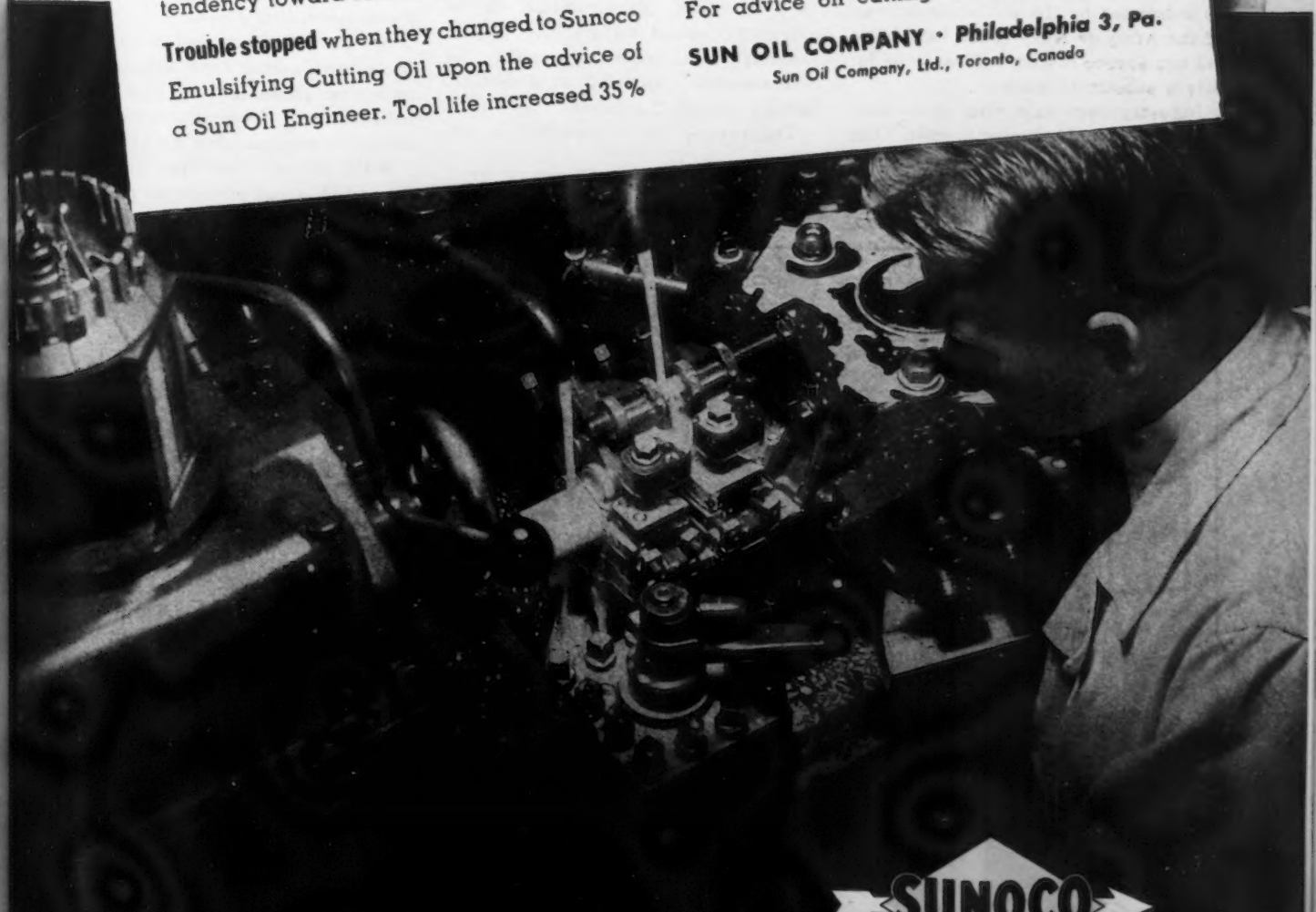
Production was slowed because of trouble on machines using a competitive soluble cutting oil. Tool casualties ran high, finish of parts was inferior, emulsions showed a tendency toward rancidity.

Trouble stopped when they changed to Sunoco Emulsifying Cutting Oil upon the advice of a Sun Oil Engineer. Tool life increased 35% . . . finish was noticeably finer . . . rancidity stopped. And in addition, cutting oil costs were cut.

Now parts are speeded from the machines of this plant . . . and from hundreds of other plants that have found Sunoco Emulsifying Cutting Oil a spur to machine tool output. Sunoco's exceptional heat-absorbing quality and stability make it the answer for all metal cutting operations where a soluble oil is used.

For advice on cutting oil problems, write

SUN OIL COMPANY · Philadelphia 3, Pa.
Sun Oil Company, Ltd., Toronto, Canada



SUNOCO

SUN INDUSTRIAL PRODUCTS *HELPING INDUSTRY HELP AMERICA*

machine tool production, WPB officials indicate.

H. Roland Swift, chief of the division's Financial Section, said that the machine tools and attachments which remain unassigned in pool orders are now down to $33,500,000, whereas they originally totaled $1,800,000,000. The remainder is being withdrawn at the rate of approximately $4,000,000 a month, although some probably will never be taken up, he said, because of their obsolete character.

WPB decentralization was blamed by one industry representative for difficulty experienced by some tool buyers in getting their orders filled. Present procedure is to process PD-1-a (Form WPB-541) applications in the field at the various WPB regional offices, which results in the denial of a large percentage of applications for new tools. Unfortunately, few applicants understand that cases resubmitted to local offices are routed for review in Washington.

MR. CHAFEE confirmed these remarks, and said a WPB-542 (for Armed Service contractors) may be submitted by the initiating bureau of the Army or Navy if the local office did not aprove it within 10 days or locate a substitute machine.

Industry men said that they were having no trouble getting steel, that standard bearing delivery is fairly smooth, but that deliveries of special or precision bearings are not entirely satisfactory. Mr. Chafee told the committee that the division has a reserve of AA-1 preference ratings to aid in emergencies, and which will be available in the event of sudden new demands do not allow orders for bearings six months or more in advance.

Although, the chemicals bureau might now be willing to approve a return to pre-war machine tool finishes, Mr. Chafee said it was the unanimous feeling of the committee that the manpower shortage makes it advisable to continue simplified finish prescribed by L-108.

□ ○ □

Small Plants to Get Civilian Orders

Washington

• • • **In a joint statement,** Senators Tom Stewart and Kenneth S. Wherry of the Senate Small Business Complaints Subcommittee agreed that small business is being given a break according to the staff instructions WPB officials received on May 10, covering all civilian production in critical labor areas.

"It looks as though the hearings our subcommittee recently held are beginning to bear fruit," the senators said.

SWPC Director Maury Maverick who was one of the principal objector's to Staff Memorandum 42 as originally issued before the Senate Committee, is said to regard the memorandum's revision as a distinct victory for small business.

The revised order provides an exemption from the civilian production freeze for small plants which employ less than 50 persons in the critical West Coast labor areas or less than 100 persons in any other area. The senators further added that "this recognition of the special problems of small business represents a step forward."

The new order puts the decision of whether non-military production shall be stepped up to the various Area Production Urgency Committees. Review of applications for permission to increase production must also be approved by Executive Vice-Chairman Charles E. Wilson whenever it is proposed for Group I area.

Senators Wherry and Stewart had protested against "the arbitrary and sweeping character" of the original memorandum freezing civilian production in critical labor areas.

WPB officials feel that the Group III and IV areas present no particular problem, and permission for small plants to resume production in these areas whenever material and capacity are available will be more freely granted.

THE BULL OF THE WOODS — BY J. R. WILLIAMS

WHUT'RE YOU, A DOC ER SUMPIN? THIS LOOKS LIKE A DIPLOMA!
YES, IT IS A DIPLOMA FOR LEARNIN' TH' MACHINIST TRADE! THREE YEARS AT NINE CENTS AN HOUR!
IT SEEMS TO IRRITATE OLD DAVE TO SEE SO MANY GETTIN' IN ON THE MACHINIST TRADE AT SUCH BIG WAGES SO SOON
THAT'S NOT SUCH A SILLY QUESTION-- I THINK THEY'D HAVE HIRED DOCTORS TOO, IF THEY'D HAD ANY SPARE TIME!
T. M. REG. U. S. PAT. OFF. COPR. 1944 BY NEA SERVICE, INC.
THE GRADUATE
5-19
J.R.WILLIAMS

U. S. Steel Corp. Shipments Total 1,756,797 Tons in April

New York

• • • **Shipments of** finished steel products by subsidiary companies of the U. S. Steel Corp. during April, 1944 totalled 1,756,797 net tons.

The April shipments compare with 1,874,795 net tons in the preceding month, a decrease of 117,998 net tons, and with 1,630,828 net tons in April, 1943, an increase of 125,969 net tons.

For the year 1944 to date, shipments were 7,118,151 net tons compared with 6,780,810 net tons in the comparable period of 1943, an increase of 337,341 net tons.

The shipments for the first four months of 1944 were the highest on record for this period. The previous high for the first four months occurred in 1942 when 6,895,312 net tons were shipped.

Machine tools give meaning to this

jury's verdict!

It wasn't much of a story. By news standards today it was strictly Page 14. The night City Editor slugged it "delinquent—local" and the man in the slot gave it a one-column head. JURY BLAMES SLUMS FOR JUVENILE CRIME.

"Health stations, more hospitals and schools, recreational and training facilities, low-cost housing projects and community centers were recommended by the grand jury, in its final presentment yesterday, as measures to check the rising tide of juvenile delinquency in this etc., etc., etc."

Few people read it. In the midst of war and politics, it was strictly Page 14.

That's why we're running it. Because that story should be a Page 1 MUST in every city in America. Because that jury's verdict is a *national* challenge. Because it gives the lie to every brand of private or political complacency which turns away from one simple, unvarnished truth: Our sons are fighting for a *better* world than they left behind—and total victory is a long way off!

What has the machine tool industry to offer here? One very real contribution: The engineers of the basic machine tool producers have helped the men of government and of industry to plan the most desperate and gigantic production program of all time . . . and they can help those same men in planning today for the peace that must be won after the war is won!

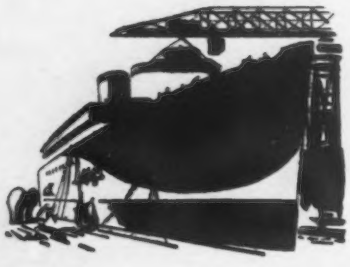
One of these is a Bryant man. We invite you to send for him.

Bryant Chucking Grinder Company

SPRINGFIELD, VERMONT, U.S.A.

WEST COAST . . . OSGOOD MURDOCK

• Western Pacific and Southern Pacific volunteer to carry finished steel from Geneva to San Francisco for $8 per ton . . . Shipment of scrap to Midwest puts "land grant" rail rates in spotlight.



SAN FRANCISCO—For the duration and six months thereafter, the Western Pacific and Southern Pacific railroads have volunteered to carry finished steel, including plates, bars and shapes from Geneva, Utah, to San Francisco Bay for $8 per ton. Section 22 of the Tariff Act permits railroads to allow rates lower than the established commercial tariff to agencies of the federal government, political subdivisions or eleemosynary institutions. Since all shipments from Geneva will be by a government agency and title will remain with an agent of DPC until delivery, the $8 rate may be applied to shipments to commercial buyers as well as to the Maritime Commission.

The regular tariff rate is $12 per ton from Geneva to San Francisco, $17 per ton from Minnequa, Colo. (CF&I), to San Francisco and $22 per ton from Chicago to San Francisco, for the same commodities. The Traffic Bureau of the Department of Industrial Development of the State of Utah asked I.C.C. for a rate of $5.31, basing this on the current rate of $4.95 per gross ton on pig iron from Geneva to San Francisco and on a coastwise competitive rate of long standing of $4.40 per net ton for finished steel, including plates, applying from Fontana to San Francisco. It is understood that DPC sought and suggested a rate of approximately $7. It is further understood that the rate of $8 was volunteered by the Western Pacific Railroad and although the Southern Pacific holds it is too low, SP has reluctantly fallen in line.

No rate has yet been announced to Los Angeles, and it is understood that carriers serving the Pacific Northwest ports of Portland and Seattle, principally the Union Pacific on this haul but involving also the Northern Pacific and Great Northern, hope to work out a slightly greater rate. Prewar intercoastal water rate on plates from eastern seaboard to Pacific Coast ports was $13 per ton, directly reflected in the mill price differential of present ceiling prices.

Industrial zealots in Utah feel that the $8 "Section 22" rate is too high and that in order to assure the Geneva mill's competitive future a rate to tidewater must not be over $6. This great open question has not been answered, but further discussion has probably been postponed until six months after the duration.

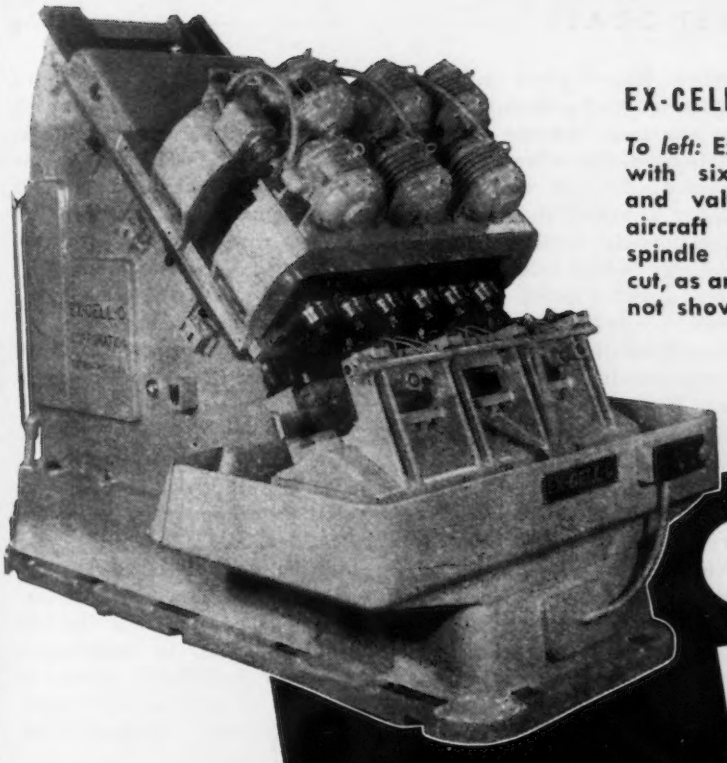
WHEN upwards of 150,000 tons of shipyard scrap move from Pacific Coast Maritime yards to midwest steel mills with rail freight waybills specifying "government land grant rates," this historic traffic loophole becomes of major interest in steel economics.

Recently the Santa Fe has given wide publicity to the fact that in more than 80 years its net realization from land grant land has been about $23,000,000 whereas in 1943 alone the government received from Santa Fe in the form of rate reductions approximately $40,000,000. Such deductions in less amount have been allowed steadily for over 50 years. President Jeffers of the Union Pacific recently testified that claims by his line against the government for improper land grant deductions now total some $50,000,000, and when the books are all balanced on current scrap shipments these claims will mount considerably.

Railroads are campaigning actively to have land grant rates abolished entirely and the Interstate Commerce Commission is understood to approve the petition.

As the law and provision now stands, these rates apply only to traffic for the Army and Navy, and the deduction is 50 per cent. But the deduction technically only applies on that part of certain lines originally constructed under land grant agreement. West of the Mississippi and Missouri Rivers, the Santa Fe is land grant from Atchison, Kan., to the Kansas-Colorado line and from Albuquerque, N. M., into Mojave and Los Angeles, Cal. The Northern Pacific is land grant from St. Paul to Seattle and Portland and the Southern Pacific from Roseville near Sacramento, Cal., to Portland. On the principle of equalization other lines extend land grant rates between points over their lines in the same ratio that traffic could be routed over land grant lines where existing. For instance, from Richmond, Cal., to Chicago in hauling scrap, cars could be routed by way of Roseville, Portland, Spokane, Minneapolis and Chicago so that they would travel 97 or 98 per cent over land grant lines. Therefore, by any route 98 per cent of the charge for acceptable land grant shipment is billed at 50 per cent of the commercial rate and from 2 to 3 per cent at the commercial rate, representing that part of the journey which travels over non-land grant right-of-way. From Los Angeles the land grant percentage is smaller because of the greater gaps en route. No shipment from Geneva, Utah, or Minnequa, Colo., or interior points not on the Santa Fe or Northern Pacific can be billed at land grant rates unless part of the reasonably direct journey could be over land grant trackage.

WIDE difference of opinion exists as to what shipments are for the purposes of the Army and Navy. How about lend-lease, for instance, when hundreds of locomotives for Russian railroads are shipped on flat cars to Portland? How about food for natives of the South Seas or beads and trinkets to win their favor? And how about scrap metal owned by the Maritime Commission, a surplus from shipbuilding, destined for private, commercial steel mills in the midwest? Where does the Army and Navy enter that relationship? the railroads ask. In procedure, the rail-



EX-CELL-O CYLINDER BORING MACHINE

To left: **Ex-Cell-O angular type machine equipped with six spindles to finish bore valve seats and valve guide holes in cylinder head of aircraft engine on a production basis. Each spindle is individually adjustable for depth of cut, as are the tools in the boring bars (boring bars, not shown in picture, are piloted in the fixture).**

SPECIAL MACHINES

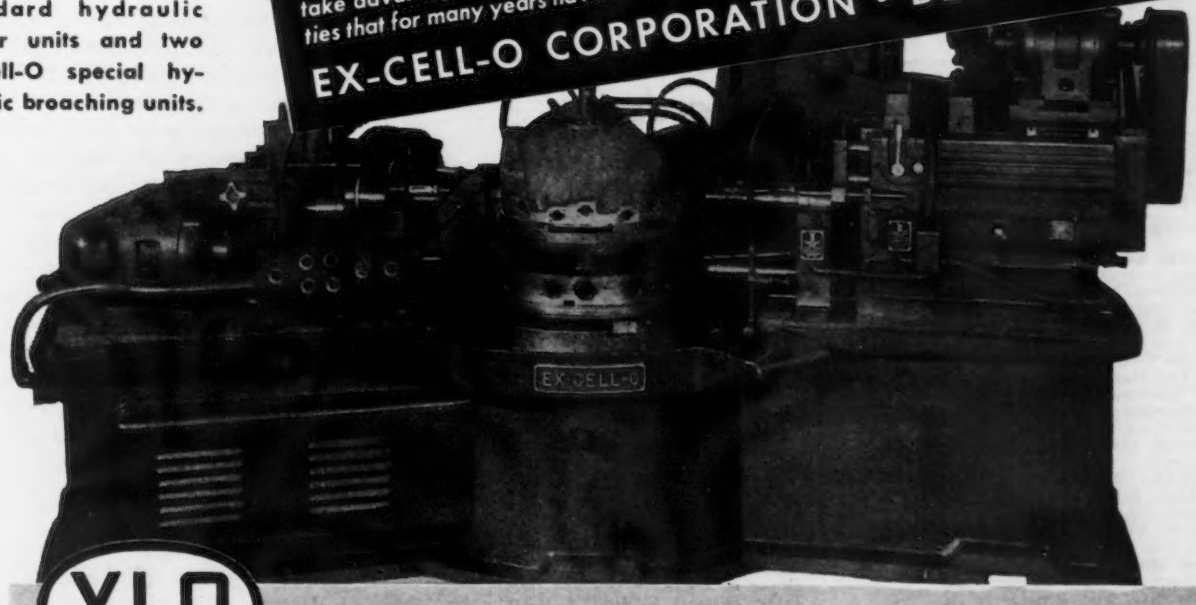
. . . for today's production . . . and tomorrow's

For years Ex-Cell-O has been familiarly known as "the headquarters" for special single-purpose machines for turning out accurate parts at a high rate of speed . . . machines that frequently perform numerous operations in one setting of the work and often bring not only a substantial increase in the number of parts produced hourly but also improved quality and reduced unit cost. . . . This is why so many manufacturers have turned to Ex-Cell-O for equipment to meet their war production schedules; why Ex-Cell-O designed machines will figure in the post-war plans of an increasing number of American industries. . . . If you are planning for tomorrow, when the new standards will necessitate costs that are competitive, take advantage of the wide engineering experience and extensive manufacturing facilities that for many years have made Ex-Cell-O a leader in the precision machine tool field.

EX-CELL-O CORPORATION • DETROIT, MICH.

EX-CELL-O SIX-WAY MACHINE

Below: **Ex-Cell-O six-way machine for drilling, broaching and reaming valve guide holes in a magnesium crankcase. This machine is equipped with four standard hydraulic power units and two Ex-Cell-O special hydraulic broaching units.**



XLO

EX-CELL-O *for* PRECISION

Precision **THREAD GRINDING, BORING AND LAPPING MACHINES • TOOL GRINDERS • HYDRAULIC POWER UNITS • GRINDING SPINDLES • BROACHES • CONTINENTAL CUTTING TOOLS • DRILL JIG BUSHINGS • DIESEL FUEL INJECTION EQUIPMENT PURE-PAK CONTAINER MACHINES • R. R. PINS AND BUSHINGS • PRECISION PARTS**

roads will bill these protested shipments at full commercial rates. The government accounting offices will deduct their remittance by approximately 50 per cent. Claims will then be filed and after years of litigation and adjudication, final settlement will be arrived at.

In the case of these 150,000 tons of scrap, the Richmond-Chicago land grant rate is approximately $8 per ton, and the commercial rate approximately $15 per ton, so that over $1,000,000 in freight claims is involved, a tidy sum, even in these days.

REALISTIC economists shake their heads when they contemplate shipping 150,000 tons of scrap all rail 2500 miles to Chicago, to be melted and rolled into new plate to be shipped back to the West Coast to build more ships from which more scrap will originate.

All the while at Fontana, 50 miles from the Pacific Coast, a plate mill built with $100,000,000 of government money struggles with pig made from low grade ore and high cost coke, the coal for which was hauled 700 rail miles from Utah. The present scrap pile there is reported less than 30 days' supply even on the 50-50 ratio instead of an 85-15 or 90-10 operation of other West Coast open hearths. About half the scrap now at Fontana is loose turnings and contaminated material bought at a bargain, and yet costly or even useless for open hearth use.

Another much larger plate mill, built with $200,000,000 of government money, and standing starved for manpower at Geneva, 700 miles from the Pacific Coast, depends entirely upon pig iron for its ingots and plate.

By the questionable issuance of government bills of lading and specification of land grant rates, overpressed railroads are expected to haul all this transcontinental scrap for half rate, approximately $8 per gross ton to Chicago. When new plates are shipped to the West Coast from Chicago the freight rate is $22 per net ton, or $24.64 per gross ton. Thus WPB rolls up a sizable freight bill on the taxpayers in its present insistence that West Coast buyers shall not get their hands on shipyard scrap unless they pay ceiling prices for all the shredded cans, turnings, borings and No. 1 and No. 2 grades and bundles that originate in the Far West.

Impartial observers are asking why scrap from shipyards on the West Coast should not first be offered to West Coast mills on as favorable a basis as to any other buyer. If they are unable to absorb all offerings and unless there is a desperate shortage in the Middle West, why not stockpile at Fontana and Geneva, insisting that these government financed plants use scrap instead of pig for the ship plate they are rolling for Maritime Commission and Navy orders? Millions of ton-miles of freight hauls would be saved thereby, hundreds of thousands of dollars in freight charges and land grant rate claims would be avoided, and at the same time all the facilities available for steel production on the West Coast would be used to their greatest advantage and with the best and cheapest raw materials available.

EARLE M. JORGENSEN CO., steel distributors, have just received authorization to build a 216-ft. extension to their No. 1 warehouse in Los Angeles. This project is in addition to the construction of a 70 x 482 ft. craneway between warehouse No. 1 and No. 2, authorized recently and for which the foundations have already been laid.

In addition to their regular warehouse stocks, the Jorgensen Co. carries an earmarked stock for the aircraft industry, and, in cooperation with the PAW and WPB, agreed to carry a stock of special alloy steels for the manufacture of rock bits and core bits. The additional storage facilities are to take care of the increased tonnage.

. . . Cited for Awards . . .

• • • **The following companies** have won the Army-Navy E award for outstanding war production:

Sylvania Electric Products, Inc., Danvers, Mass., and two plants in Salem, Mass.
Signode Steel Strapping Co., Chicago.
United Specialties Co., Chicago.
George D. Roper Corp., Rockford, Ill. (second star)
Cochrane Corp., Philadelphia.
Buda Co., Harvey, Ill.
Danly Machine Specialties, Inc., Cicero, Ill.
Aro Equipment Corp., Bryan Plant, Bryan, Ohio. (star)
Aluminum Industries, Inc., Cincinnati. (second star)
Norton Co., Worcester. (fourth star)
American Red Cross, Blood Donor Center, Kansas City.
James B. Clow & Sons, National Cast Iron Pipe Co., Tarrant, Ala.
General Motors Corp., General Motors Truck & Coach Division, Pontiac, Mich.
Gorham Mfg. Co., Providence.
John W. Hobbs Corp., Springfield, Ill.
International Chain & Mfg. Co., York, Pa.
International Equipment Co., Boston.
International Steel Co., Edgar Street Plant, Evansville, Ind.
Lovejoy Tool Co., Inc., Springfield, Vt.
Metals Disintegrating Co., Inc., Verona Plant, Verona, N. J.
Nice Ball Bearing Co., Plant No. 1, Philadelphia.
Parker Rust Proof Co., Morenci Michigan Chemical Mfg. Plant, Morenci, Mich.
Republic Aviation Corp., Indiana Division, Evansville, Ind.
Studebaker Corp., Automotive Division, South Bend, Ind.
Torrington Co., Westfield Mfg. Co., Westfield, Mass.
United Specialties Co., Chicago.
United States Finishing Co., Norwich Branch, Norwich, Conn.

Maritime M

The following companies have been awarded their first gold star:

Baltimore Copper Paint Co., Baltimore.
Bethlehem Steel Co., Lackawanna, N. Y.
Columbia Steel Casting Co., Portland, Ore.
Cramp Brass & Iron Foundries Division, Baldwin Locomotive Works, Philadelphia.
Curtis Lighting, Inc., Chicago.
Devoe & Raynolds Co., Inc., New York.
Foran Foundry & Mfg. Co., Flemington, N. J.
Globe Co., Chicago.
Inland Steel Co., Chicago.
Jones & Laughlin Steel Corp., Pittsburgh.
Penn Steel Castings Co., Chester, Pa.
Phelps Dodge Copper Products Corp., Los Angeles Tube Division, Los Angeles.
Pottsville Castings & Machine Shops, Inc., Pottsville, Pa.
Warman Steel Casting Co., Los Angeles.
Youngstown Sheet & Tube Co., Youngstown.

Steel Industry Payrolls Total $145,285,000 in March

New York

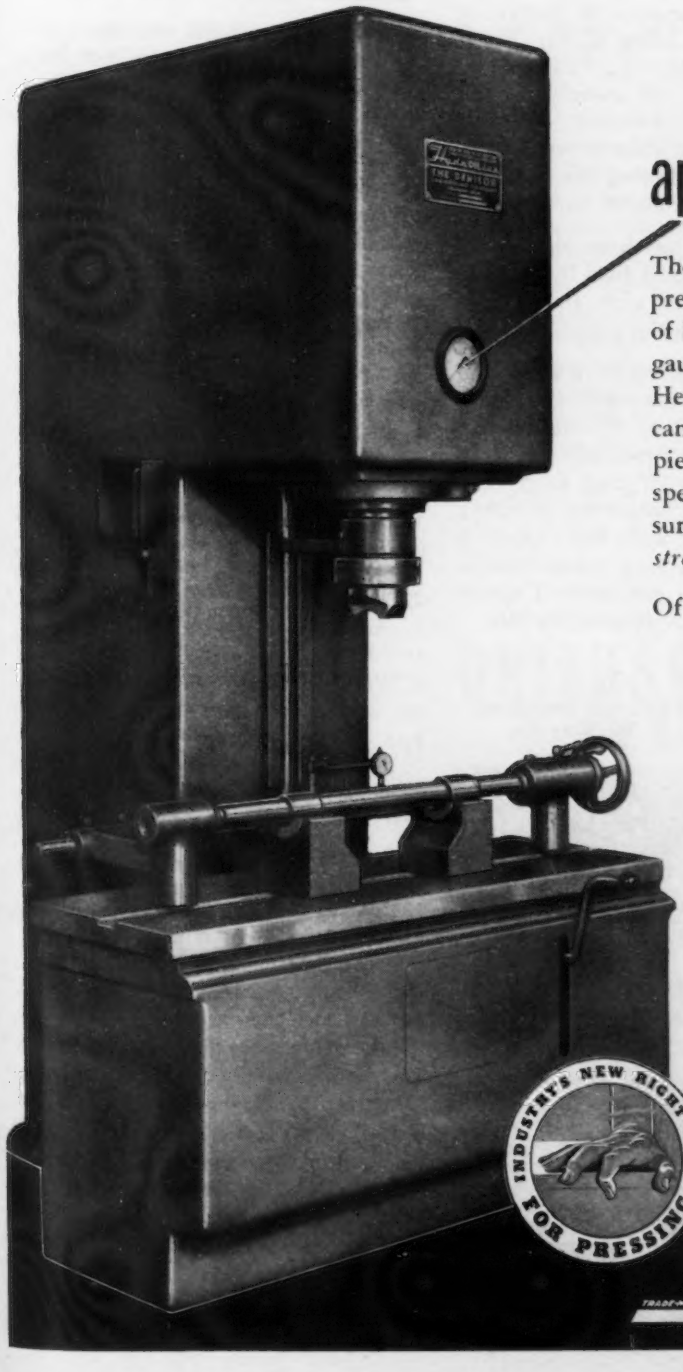
• • • **Steel industry** payrolls established a new high record of $145,285,000 in March, according to a report released today by the American Iron and Steel Institute. The previous peak payroll was the total of $144,937,000 in October, 1943. The March, 1944, payroll compares with $137,615,000 in February and with $136,813,000 in March a year ago.

The average number of employees in the industry declined in March, however. During that month an average of 578,000 employees was at work as against 583,000 in February. No comparable figures for averge number employed are available for March, 1943, but total number at work in March last year was 637,000.

Wage-earning employees worked an average of 47.7 hr. per week and earned an average of $1.159 per hr. in March, 1944. Their indicated average weekly earnings of $55.28 in March stand as a new record.

In February, hourly earnings averaged $1.161 and the average workweek was 47.0 hr. bringing weekly earnings to an average of $54.57. In March, 1943, steel industry's wage earners earned an average of $1.103 per hr. and worked 42.5 hr. per week, indicating average weekly earnings of $46.88.

What! No Adjusting?



apply pressure just as needed

The easy-action hand lever of this *HydrOILic* straightening press gives the operator *direct, instant, continuous* control of both ram movement and tonnage. A glance at the pressure gauge shows him the exact tonnage exerted at any moment. He can fit the pressure to any job quickly, as he goes. He can work closely to the predetermined stress limits of any piece of work. He can increase tonnage slowly, or at full speed . . . steadily or intermittently. And he can apply pressures in repeated thrusts *without waiting through a full stroke of the ram.*

Of course, where any operation is to be repeated many times, stroke and pressure limits can be pre-set as required — pressure from 15 to 150 tons, stroke at any point up to 18 inches.

HydrOILic Presses add other advantages to this quick, wide-range flexibility — such as space-saving compactness, fully enclosed and protected mechanism, round-cornered "safety" frames, extra toe space and many others. This DLSC2 is also available in 25, 50 and 100-ton capacities. Write for details on these and other types of HydrOILic Presses.

THE DENISON ENGINEERING COMPANY
1158 Dublin Road Columbus 16, Ohio

DENISON EQUIPMENT *in* APPLIED HydrOILics

PERSONALS

PAUL T. FARRELL, assistant to the president, Stran-Steel Division, Great Lakes Steel Corp.

• **Paul T. Farrell,** director of purchases for Great Lakes Steel Corp., Detroit, has been appointed to the newly-created position of assistant to the president, Stran-Steel Division, with headquarters in Washington. He has been director of purchases for Great Lakes and its various divisions, and for the Hanna Furnace Corp., since December, 1942. He joined Great Lakes as its purchasing agent in 1929, when the company was being formed.

• **L. C. Hatch** has been named manager of the Winch and Crane Division of Gar Wood Industries, Inc., Detroit, to succeed **G. E. Robinson,** retired. Mr. Hatch joined the company in 1934 as a draftman, was promoted to sales engineer in 1937 and was made assistant manager of the division in 1940.

• **James V. Donohoe,** formerly of the New York office of the Mixing Equipment Co., Inc., has been promoted to assistant sales manager at the Rochester home office.

• **John P. Dods,** director of research and advertising manager for the Summerill Tubing Co., Bridgeport, Pa., has been appointed director of advertising and sales promotion for the closely affiliated interests of the Columbia Steel & Shafting Co., the Edgar T. Ward's Sons Co., and the Summerill Tubing Co.

• **R. W. Thompson** has been appointed director of engineering for General American Transportation Corp., Chicago, and its subsidiaries and divisions. He joined General American 24 years ago. Most recently, he has held the position of chief engineer.

• **L. J. King,** formerly chief industrial engineer for Carnegie-Illinois Steel Corp., has been appointed cost planning supervisor of U. S. Steel Corp. of Delaware, Pittsburgh. First employed as industrial engineer in C-I Homestead Works, he later went to U. S. Steel's general office in that capacity. He was made chief industrial engineer in 1936 and had served at Carnegie-Illinois in that capacity since 1940.

• **Gilbert H. Corbin,** formerly field sales manager of its Laundry & Dry Cleaning Division, has been appointed district sales manager in charge of the Minneapolis office of the Pennsylvania Salt Mfg. Co., Philadelphia. Mr. Corbin has been associated with the Company's Laundry & Dry Cleaning Division since it was established in 1940, following the purchase of the Sterling Products Co.

• **B. F. DeFord** has been elected assistant secretary and **John R. Reuling,** assistant treasurer of the Pemco Corp., Baltimore, Md.

• **Otto W. Winter** has been appointed vice-president of the Acme Pattern & Machine Co., Buffalo. He has been a former national president of the American Society of Tool Engineers, has held various positions in many tool companies, and has spent a period in Russia as a consultant on machine tool and cutting tool manufacture to the Soviet government.

OTTO W. WINTER, vice-president, Acme Pattern & Machine Co.

EARL A. TANNER, president, Inland Steel Container Co. and Milcor Steel Corp.

• **Earl A. Tanner** has been elected president of the Inland Steel Container Co., Chicago, a subsidiary of Inland Steel. Mr. Tanner who has been president since 1938 of the Milcor Steel Co., Milwaukee, another Inland subsidiary, will head both companies.

• **W. O. Everling** has been appointed director of research of the American Steel & Wire Co., U. S. Steel subsidiary, succeeding the late J. S. Richards. **R. H. Barnes** succeeds Mr. Everling as assistant director of research. Mr. Everling's first association with the U. S. Steel Corp. dates from 1927, when he joined the Carnegie Steel Co. In 1930, he joined the American Steel & Wire Co., becoming assistant director of research in 1940. Mr. Barnes has been with the company since 1920, holding various positions prior to being appointed division metallurgist, a post which he has held to the present time.

• **Edward N. Haas** has been appointed works manager of the Aurora, Ill., plant of Independent Pneumatic Tool Co., Chicago, succeeding **W. H. Brewer,** who has been named general factory manager. **John P. Bank** succeeds Mr. Haas as assistant works manager.

• **E. A. Wall** has been appointed controller of Winchester Repeating Arms Co. and Bond Electric Co., divisions of Western Cartridge Co., East Alton, Ill. He has been with the company for the past 24 years, and since 1928 has been in charge of Winchester's cost department.

• **Maurice N. Trainer,** first vice-president of the American Brake Shoe Co., has been elected a director. He was made first vice-president last year. He has been president of the Brake Shoe and Castings Division of the company since 1939.

• **Col. E. F. Miller** has been appointed vice-president and general manager of American Steel Export Mexicana, S. A., Mexico City. He will supervise all seven departments of the parent company in Mexico as well as the interests of the ASECO Corp., an affiliate organization.

• **F. H. Frankland,** director of engineering for the American Institute of Steel Construction, has resigned to begin private practice as a consulting engineer.

• **Fred J. Tobias** has been named production engineer, Sam Tour & Co., Inc., New York. **Theodore Rubin** has been made metallurgist; **Robert Rogolsky** and **Lewis W. Gleekman** assistant metallurgists.

• **C. F. Norberg** has been elected vice-president in charge of manufacturing, and **D. N. Smith,** comptroller of Electric Storage Battery Co., Philadelphia.

• **Dr. Robert B. Sosman** and **Dr. James B. Austin** have been appointed assistant directors of U. S. Steel's Research Laboratory at Kearny, N. J. They have been members of the staff of the Research Laboratory since 1928.

• **Julian A. Pollak** has been elected president, The Pollak Steel Co., Cincinnati; **Albert C. Weihl,** becomes vice-president and general manager; **Virgil W. Prather,** secretary, and **Charles M. Grimm,** treasurer.

• **George S. Eveleth,** assistant to the president of the International General Electric Co., Schenectady, N. Y., has been elected a vice-president of the company. He joined International General Electric in 1920. Mr. Eveleth is also vice-president and director of Anderson Meyer & Co., IGE's representative in China, and director of several other foreign affiliates of IGE.

• **H. R. Rowland,** formerly manager of the Pittsburgh division, has been appointed manager of wrought iron hot rolled sales of A. M. Byers Co., Pittsburgh. He has been with the organization since 1915. **M. C. Morgan** succeeds Mr. Rowland as head of the Pittsburgh division. He was formerly assistant manager of that division and has been with Byers since 1923.

H. V. ERBEN, commercial vice-president, and ROBERT S. PEARE, vice-president, General Electric Co.

• **H. V. Erben,** manager of the Central Station divisions since 1941, and **Robert S. Peare,** manager of publicity and broadcasting, and chairman of the general advertising committee, General Electric Co., Schenectady, N. Y., have been elected commercial vice-president and vice-president, respectively. **Willard V. Merrihue** has been named manager of the advertising and sales promotion divisions of the Apparatus Department. He was formerly assistant to Mr. Peare.

• **Edward T. Nahill** has been made sales manager, Ace Mfg. Corp., Philadelphia.

• **William P. Headden** has been appointed assistant manager of the Sales Engineering Department of the Standard Oil Co. of N. J. Since 1943 he has been supervisor of the fuels and lubricants section of the division.

• **Dr. J. T. Rettaliata** has been appointed manager of the new Research and Gas Turbine Development Division of Allis-Chalmers Mfg. Co., Milwaukee. **J. L. Ray** will assist Dr. Rettaliata.

• **John W. Barriger, III,** has been appointed manager of the newly created Diesel Locomotive Division, Fairbanks, Morse & Co., Chicago.

OBITUARY...

• **John F. Hazen,** formerly manager of sales, wire and wire products, Bethlehem Steel Co., died April 14. He had retired from the company last December.

• **George H. Shill,** assistant to Hardage L. Andrews, vice-president in charge of General Electric Co.'s Appliance and Merchandise Department, Bridgeport, Conn., died on April 27.

• **Michael J. Curtin,** general superintendent and assistant works manager of the William Sellers & Co., Philadelphia, died May 7. He was 46 years old.

• **Henry A. Zwierlein,** for the past 20 years chief engineer for the Ajax Mfg. Co., Cleveland, died May 6. He was 55 years old.

• **Henry M. Johnson,** with the A. O. Smith Corp., as production manager, later a partner in the Griffith-Hope Co. and a director of the Badger Meter Co., Milwaukee, died April 30 at the age of 64 years.

• **Wilbur S. Locke,** for 48 years sales representative of the Carnegie-Illinois Steel Corp. in New England until his retirement in 1941 died at his home in Winchester, May 1. He was 73 years old.

• **E. D. Dickinson,** who at the time of his retirement last year was designing engineer of the Turbine Engineering Division of General Electric's Lynn River Works, died on April 28 at the age of 66 years. He was in the company's employ for 43 years.

• **Franz Eder,** for the past 37 years consulting engineer with Robert W. Hunt Co., New York, died April 28.

Fatigue Cracks . . .

BY A. H. DIX

Setback for Beauty

• • • Beauty was kicked squarely in the teeth last week by H. T. Johnson, General Motors' Director of Standards, who told the machine tool builders that he could not recall a single instance where good looks had anything to do with the buying of machine tools.

Not that Mr. Johnson is an advocate of ugliness for its own sake. It is just that he wouldn't give you as much as an expired "A" coupon for streamlining if it meant, as he proved it frequently does, a sacrifice of utility.

Being strictly hard shell in the matter of utility vs. pulchritude, Mr. Johnson has probably over-discounted the influence of eye appeal, but his philosophy is refreshing and we hope it leaks into the chambers where automobiles are designed. For even in the case of these wind-meeting mechanisms the hell-fer-leather chase after streamlining seems to us to have over-run the goal. After four years we still have not acquired the knack of sliding into our 1940 Dodge without pushing our fedora over our ears.

Cast Battles

. . . I stood with a naval officer on a hill overlooking our principal South Pacific naval base. "This is the foundry," he said, "in which great naval battles are made."

—*News report in the New York Times*

On the grounds that it must not show favoritism, the Navy rapped our knuckles for throwing a mess of little asterisks into our recently published tables of comparable arc welding electrodes, to show which brands are Navy-approved. We would therefore like to caution the Navy against implying even metaphorically that sea battles are cast, rather than machined, welded, forged, pressed, spun, or electro-deposited.

Aptronym

. . . The head of the Canadian Fisheries Experimental Station at Halifax is Dr. D. B. Finn.

—*E. J. Royon*

Gloom Chaser

• • • As they usually have large metal-working departments, most of our snootier penitentiaries subscribe for your favorite family journal. We cherish this portion of our circulation because of its promising postwar prospects, and are happy to announce a new member, the Illinois State Penitentiary at Pontiac, Ill.

We noticed it particularly when it was going through the mill, as the order was marked "Charge to Amusement Fund."

Subconscious Revenge

• • • Tom Lloyd of the brains department says that once he bet a newspaper friend that he could find at least two dozen typographical errors on the first page of any first edition. The bet was taken up and he found 40. The miracle is, of course, that there were not more, considering the speed with which newspaper copy is set and printed.

Most of the typos—we were a newspaperman once ourself—are undistinguished, but a linotype operator for the New York Herald-Tribune perpetrated a pretty one recently by referring to the army officer candidate center in Ann Arbor, Mich., as the pudge advocate feneral school.

This is too involved to be accidental, and as all errors have a subconscious base, we figure it out that the operator was court-martialed in the last war and that the judge was a short, fat officer. "Feneral" is obviously psychic slip for "funeral."

Cosmic Yen

• • • Out of its boundless knowledge, the brains department answers effortlessly most of the questions asked of it by revering readers. But every now and then we get a cosmic question, with scope so vast that all we can do is gape.

Such a one has just come in from Walter Berrier, 274 West 5th St., Lexington, N. C., who asks:

Would you please send me any information concerning mechanical and engineering.

We wouldn't know where to begin, Walter, but if you will fence off a section of this universe we will see what we can do.

Birthday

• • • All our life we have been looking for an opportunity to use the word "undecennary," which our drug store dictionary informs us means eleventh anniversary, and at last we have it, for eleven years ago today this page was born, under the title "Just Between Us Too," in your family journal's issue of May 18, 1933.

Our first item was headed "Hooray!" The Depression is Over! Maybe." The depression gloom was just about beginning to lift, but we were not sure at the time whether the rift in the clouds was temporary or not. There was a paragraph on the then new metal beer kegs and metal beer bottle cases, and a few testimonials. On the whole it was pretty dull.

Mayflower Descendants All

• • • For our next undecennary we would like to record here that too much of our time at the moment is taken up in signing awe-inspiring secrecy agreements sent us by certain aircraft and other war goods plants. We have to sign them before we can get our money for an $8 subscription.

The documents are impressive. They require us to withhold from any alien in our employ "*drawings, specifications or models concerning projects of a secret, confidential, or restricted nature, without the written consent of the Secretary of War or the Secretary of the Navy.*"

We would not think of bothering either gentleman, as he is too busy; and furthermore we have no aliens, nor for that matter have we any secret drawings or models. All we want is our $8, and we wish we could get it without signing something that makes us feel a little foolish, like a small boy feels when an adult examines his G-man badge.

The war plants that mail out these agreements indiscriminately can spare embarrassment to us and other vendors of innocuous materials, by making some kind of a mark on their records to indicate "harmless," so that we can get our money without all this fuss.

Three Ciphers Shy

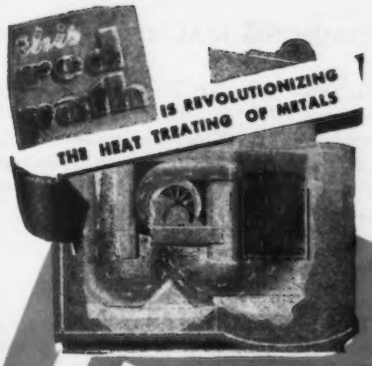
• • • Which reminds us to brag that an engineer in one of the giant war goods companies, with many plants, asked us to guess how much money an idea published here about thirteen months ago had saved his firm. We said "A couple of thousand dollars?" He said, "At the least, two million." He seemed very pleased about it.

Puzzles

• • • Last week's cat weighed, as you saw in a flash, 4 lb.

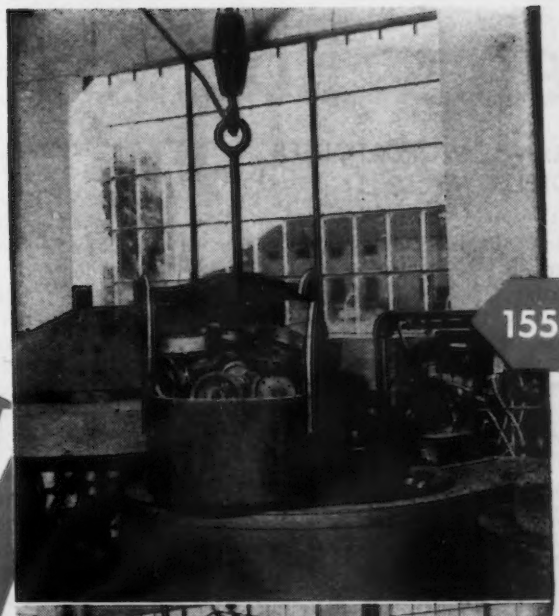
Ninety seconds is par for this:

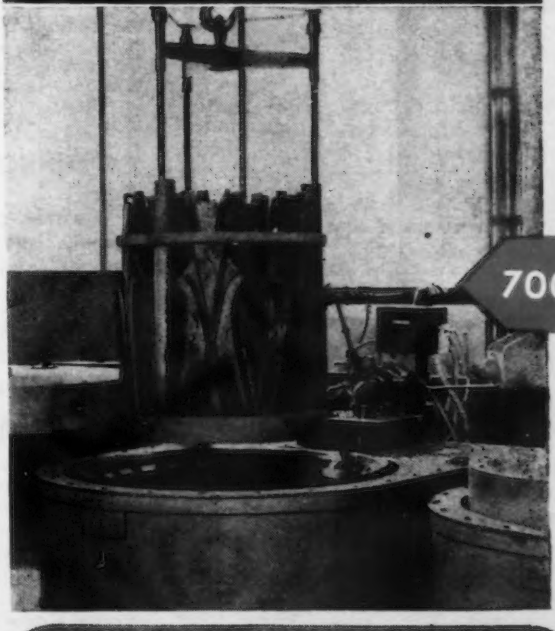
Three boys make $98. Boy No. 2 makes $11 more than Boy No. 1. Boy No. 3 makes $28 less than Boys No. 1 and No. 2. How much does each make?



Versatile!

The Lindberg Super-Cyclone Furnace





For all metal treating, utilizing heats from 300° to 1750° F., the Lindberg Super-Cyclone Furnace gives complete versatility.

For instance, in the photographs here, a charge of gear blanks is just going into the Super-Cyclone at 1550° F. Next a load of gate valve weldments is being charged for stress relieving at 1100° F., and below, 16 railroad frogs are lowered into a temperature of 700°F. for tempering. All using the same Super-Cyclone Furnace!

When a load must be reheated at a lower temperature, after quenching, the Super-Cyclone can be accurately brought down to the proper heat while the load is in the quench, saving precious time and rehandling.

The Super-Cyclone operates on a principle of fan driven hot air from an isolated heating chamber racing at high velocity through the most compact load to build up temperature with rapid uniformity. This allows temperatures to be built up or reduced with amazing speed. And there is a complete avoidance of radiant heat that causes distortion.

This revolutionary heating principle saves time and space, keeps work straighter and cuts production costs. Write for complete information to Lindberg Engineering Company, 2452 W. Hubbard St., Chicago 12.

ARMY NAVY

LINDBERG FURNACES

SUPER-CYCLONE for hardening, normalizing, annealing, tempering
CYCLONE for accurate, low-cost tempering and nitriding
HYDRYZING for scale-free and decarb-free hardening

Dear Editor:

STRANGE WORDS; QUEER BEDFELLOWS

Sir:

Someone recently forwarded to me your Apr. 20 editorial, "Strange Words; Queer Bedfellows," thinking, perhaps, that I would be impressed, since his reasoning is a facsimile of Mr. Van Deventer's. Frankly, I feel he has strained both logic and reason and has come to most unwarranted conclusions.

For a real, dyed-in-the-wool isolationist, you need not search beyond the limits of your State of New York. You have a honey right there in Mr. Hamilton Fish. Mr. Fish, through his votes, attempted to defeat every war-preparation measure, including Selective Service, from 1938 on, and "on" means up to date. Through his articles for Mr. Vierick (a convicted German agent) and by his speeches for that pseudo-patriotic America First Commitee, he attempted to assuage the American people's apprehension of possible danger. . . . He has many colleagues, too: Burt Wheeler, Gerald Nye, Clare Hoffman, Robert McCormick, Gerald Smith—all noble Americans, so they say, but all trying desperately to hamstring the war effort, all griping incessantly about our terrible civilian sacrifices, and some still favoring a negotiated peace.

This picture must have escaped your Mr. Van Deventer, but most I think will agree that it is a better definition of a rough and ready U.S.A. isolationist than his.

I might also add that he badly misquoted Mr. Roosevelt. He did not say that no American soldier would be called upon to fight on foreign soil. He did say that no American soldier would be called upon to fight on foreign soil *unless attacked.* It's curious how little deletions enormously change the meaning.

As to the implications of the Wisconsin vote, I again feel you are injecting a meaning wholly without foundation. The majority vote went to Mr. Dewey who just a few weeks before came out strongly for an Anglo-British post-war alliance, and in the same talk castigated the isolationist, Mr. Gerald Smith. As most people know, the victory in Wisconsin was a victory for the regular party County Chairmen and the district ward heelers, the same as in 1940, when all twenty-four delegates pledged to Mr. Dewey were victorious.

Internationalism does not require altruism. In my concept, internationalism is the vehicle of greatest self-interest, since the reverse, whatever you wish to call it, which we pursued in the 20's has been categorically proved by history to have been diplomatically and economically stupid. I might quote from a recent article in *Fortune* (Feb. 1944): "Meanwhile the U. S. played perhaps the most destructive role of all. Her insistence that French and British war debts be made good forced both countries to pad their claims against Germany. Meanwhile, the U.S. steadily advanced tariffs, thus making collection of debts impossible."

R. R. S.
Boston, Mass.

Sir:

Mr. Van Deventer has indeed written many, many splendid editorials. Few if any, however, strike the chord like the one in the issue of Apr. 20, "Strange Words; Queer Bedfellows."

N. J. HIGINBOTHAM,
President
W. A. Case & Son Mfg. Co.,
Buffalo 3, N. Y.

ELECTRIC FURNACE CAPACITY

Sir:

You have an item on page 148 of your Apr. 20 issue reading, "Electric Furnace Capacity to Hit 140,000 tons per Month." At present electric furnace production is well over 300,000 tons per month and total capacity is more than 500,000 tons per month. Therefore, the excess capacity per month as of the present appears to be around 200,000 tons.

R. L. BALDWIN,
Sales Development Manager
National Carbon Co., Inc.,
Electrode Sales Division,
Niagara Falls, N. Y.

CONTINUOUS CASTING

Sir:

I would greatly appreciate a reprint of the excellent article on continuous casting in your Feb. 24 issue.

PAUL D. FROST,
Materials Department
Curtiss-Wright Corp.,
Airplane Div.—Research Laboratory,
Buffalo 5, N. Y.

● Reprint has been mailed.—Ed.

TOOL STEEL DIRECTORY

Sir:

We would appreciate it if you would let us know whether you have a later edition of the Directory of Tool Steels. The one we have was issued in December 1942.

J. M. BEK
Keeler Brass Co.,
Grand Rapids, Mich.

● A revised edition of the directory was issued in November, 1943. Prices are: $1 for single copies; 50c each for five or more. —Ed.

Sir:

Please send two copies of the booklet, Directory of Tool Steels by T. W. Lippert. We have seen one of these booklets and realize its usefulness in our business.

C. F. ROEMBKE,
Manager
Fries Tool and Machine Works, Inc.,
1918 East Wayne St.,
Fort Wayne 4, Ind.

BROACHING MACHINE

Sir:

In your Mar. 30 "News Front" is a reference to "a machine which broaches to spherical dimensions." Can you give us more information regarding the machine and its manufacturer?

R. H. LUKINS,
Engineering Dept.
Union Special Machine Co.,
400 North Franklin St.,
Chicago 10

● This machine, designed and built by the Ryan Tool & Engineering Co., John R and 7 Mile Road, Detroit, is primarily for broaching the tenon and dovetail of turbine buckets on a radius to conform to the diameter of the rotor into which they are locked. A detailed article describing it is scheduled to appear in an early issue.—Ed.

STAINLESS STEEL POLISHING

Sir:

I am interested in obtaining information regarding equipment for the polishing of stainless steel. The polishing is to remove the yellowish tint which strip stainless steel used for razor blades acquires in hardening and tempering. Any information you can give me will be greatly appreciated.

GEORGE D. HARTLEY
372 May St.,
Worcester 2, Mass.

● We have published several articles on the subject; one dealing primarily with mechanical polishing and another concerned with electrolytic polishing. These articles are contained in our reprint book, "Cleaning and Finishing Metal Products." Price $3.—Ed.

FINANCIAL ANALYSIS ERROR

Sir:

I would like to call attention to an error made in the financial analysis which appeared in your April 20 issue, pages 120-121, in which the earnings of the various steel companies are cited. Those for our company have been shown incorrectly as follows:

	Reported Figure	Correct Figure
Earnings per ton ingot capacity—1943.....	$2.01	$1.95
—1942.....	1.95	2.58
Earnings per ton ingots produced—1943.....	$2.66	$1.95
—1942.....	2.60	2.60

J. L. MAUTHE,
Vice President
Youngstown Sheet and Tube Co.,
Youngstown 1, Ohio

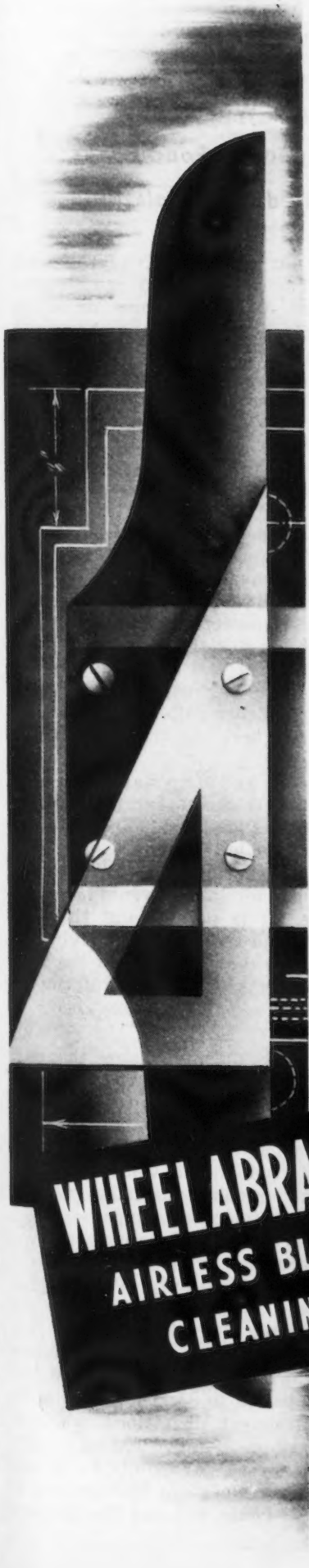
CARBIDE TOOLS

Sir:

I read with interest the article, "Gooseneck Carbide Tools" by Gaylord G. Thompson which appeared in your Apr. 13 issue. I have just had my first contact with carbide tools and must admit they certainly are temperamental. May I have a clipping of this article?

ROBERT C. BARHORST
544 Union Blvd.,
Boro. of Totowa,
Paterson 2, N. J.

● Clipping has been sent you. We suggest you keep in touch with The Iron Age each week so you may get the benefit of any new information published on the subject.—Ed.



a practical formula for blast cleaning efficiency

EFFICIENCY is America's overpowering wartime weapon . . . in the post-war competition of tomorrow it will become a prerequisite to maintaining business leadership. Efficiency in metal cleaning can be an important factor in lowering costs and bettering your competitive position. Here is a typical "case history":

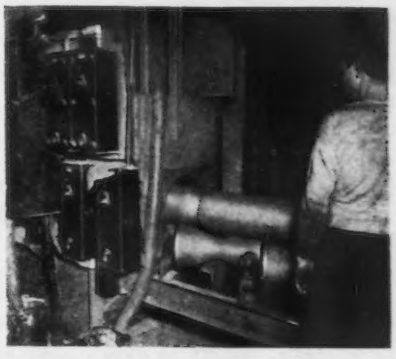
The 202 year old Taylor-Wharton Iron & Steel Company has served our country in war production through every war in its history. In World War II, when production demands were met, the hand blast cleaning process formerly used was found inadequate.

Faced with the necessity of finding a more satisfactory method of cleaning seamless steel gas cylinders they called on American's engineers. After a thorough survey of the problem, a carefully designed Wheelabrator Special Cabinet was recommended. As the work passes into the blast zone, steel abrasive thrown from the Airless Wheelabrator thoroughly scours the surface right down to virgin metal.

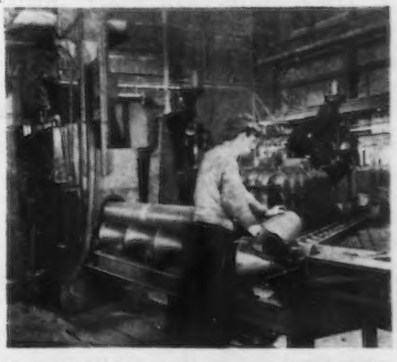
Whereas each piece required five or six minutes to be cleaned by sand blast, *three* cylinders are now completely cleaned in *one minute* by the American Special Cabinet. Production flows at a rate 15 times faster than under former methods.

You are invited to submit your problems and samples of your work to our engineers for test-cleaning in our complete laboratory — they are qualified by wide experience to give you a practical "formula" for efficient handling of your metal cleaning problems.

1. Gas cylinders waiting to be cleaned by the Wheelabrator Special Cabinet.



2. Skewed dished rollers rotate the work at a predetermined speed during cleaning.



3. A complete conveyor system handles the work so operations are continuous.

WHEELABRATOR
AIRLESS BLAST CLEANING

American
FOUNDRY EQUIPMENT CO.
510 SOUTH BYRKIT STREET MISHAWAKA, INDIANA

This Industrial Week . . .

- ***Steel Industry Entering Tightest Period Since War Began***
- ***Tinplate for Third Quarter May Be Telescoped for Food Packs***
- ***Steel Requirements May Stagger Controlled Materials Plan***

WITH attention centered on the shell program, backlogs increasing, plate cutbacks less than had been planned, order volume showing no signs of decline, the steel industry this week finds itself close to a period of tightness never before reached. Requirements for the third quarter will tax the complete facilities of the industry. There is no chance, however, that war needs which are to support the invasion will be behind schedule.

The method by which important war material must be turned out in the third quarter will probably be such as to push back many less important items much farther than has been the case up to now. For the third quarter, it now appears that WPB will have to find a home for about 195,000 tons of shell steel, about 200,000 tons of sheets, principally for the shell container program, an additional 12,000 tons of tin mill products, and an increase of more than 100,000 tons of plates for the Maritime Commission.

The mechanics of placing this substantial tonnage, which is over and above a demand already taxing the steel industry, will probably be found in directives soon to reach mills ordering them to accept more than 110 per cent of their product quota on the affected items. Actually, it is said, there is still a mounting carryover on flat rolled items which runs from 10 days to two weeks with some major producers. There is every indication that this carryover problem will become worse before it gets better.

SOME mills will start third quarter production schedules about the middle of July because of carryovers. Because the new critical programs will undoubtedly be placed on a directive basis, it may be that other duly certified Controlled Material Plan orders booked for delivery in June, July, August, and September will be delayed for from two to six weeks. It also may be the broad range of steel items will continue to carry deliveries extended somewhat into the future.

It is believed that an attempt is being made to concentrate tinplate production in the third quarter in order to supply sufficient cans for the current crop season. Such a maneuver would obviously mean a smaller tinplate output for the fourth quarter. Whether or not a substantial actual increase in tinplate can be obtained in the third quarter depends not on the desire, but on the availability of steel as well as rolling space on wide strip mills which are already jammed with plate and sheet tonnage. One item which is expected to further tighten the rolling space availability on continuous mills is the third quarter requirement for shell packaging which, it is hinted, may be more than 175,000 tons.

A tremendous distribution problem which will face the steel industry in the third quarter is bound to bring about an accentuation of the weak points in the CMP. The balancing of semifinished steel either in the form of slabs, blooms, or billets to meet the intricate scheduling of finished steel products represents a man sized job. Possible deterioration of the CMP may be evidenced currently by the issuance of numerous directives for quantities of materials running less than 50 tons in order. Railway accessory manufacturers are said to be running somewhat behind scheduled deliveries and in some instances because of difficulty in obtaining material.

Order volume in the past week was expanding in most steel centers and again in most cases exceeded shipments. Orders for sheets were heavier, and some sheet deliveries are running into the fourth quarter and into the first quarter of 1945. Bar orders are beginning to expand, especially the larger sizes, because of the shell program, and this situation will change rapidly towards further extension in deliveries by July. Obviously, order volume is heavier in the three major centers where the shell program is to be concentrated.

Aggravating the sheet and strip market recently has been heavy demands from the farm implement makers for fourth quarter delivery. The Navy is said to have recently cancelled some hot rolled barrel stock, but has frozen the tonnage, it is said, so that other consumers cannot take advantage of the openings in schedules. It is pointed out that the shell steel for the recent program is only beginning to get on mill order books, but that within the next month or so the full effects of these requirements will become felt.

TWO major labor developments during the past week indicate possible uneasiness among the rank and file for the future. Philip Murray, head of the CIO and president of the United Steel Workers of America, "barely made it" last week when he turned back a demand from the convention floor at Cleveland to recall the union's "no strike pledge." Meanwhile, at Detroit, automotive companies were having their troubles as a result of foreman strikes.

National steel operations dropped half a point this week to 98.5 per cent of capacity. Philadelphia output declined one and a half points to 99.5 per cent while at Cleveland the operating rate fell 12½ points to 83.5 per cent. Other production slumps occurred in Detroit, down half a point to 100.5 and Cincinnati down eight points to 92. Up half a point to 96 per cent are Pittsburgh operations, while at Chicago output increased one point to 102.5 per cent. In the West, production rose two points to 86 per cent. Unchanged from last week are Youngstown at 103.5; Wheeling, 99; St. Louis, 99; and the Eastern District, 97 per cent.

• **HOT WEATHER**—Steel men look for a decline in steel output this year on a larger scale than last year due to hot weather. A year ago the seasonal drop in raw steel output did not follow the pattern of other years. The summer drop in prewar years sometimes ran as much as seven per cent. The drive for steel and the tempo of last year kept the rate at an accelerated pace. This year may be different because of the manpower shortage, new employees and the continuous strain on some steel workers who have worked long hours and full weeks for more than a year.

• **PRODUCT MIX**—Unbalance in the production of finished steel products is again becoming apparent as the result of a step up in the shell program and the continuation of the tight flat rolled picture. The overall demand for steel is such that in addition to interfering with more economic scheduling of steel products it may be that output of some items will be pared because of the lack of semi finished steel. The processing of shell steel takes longer than many other items due to slow cooling, hot topping, etc. All of this means some other steel products must give way. Rail output which comes off many mills that are used in making shell steel is now definitely being hampered.

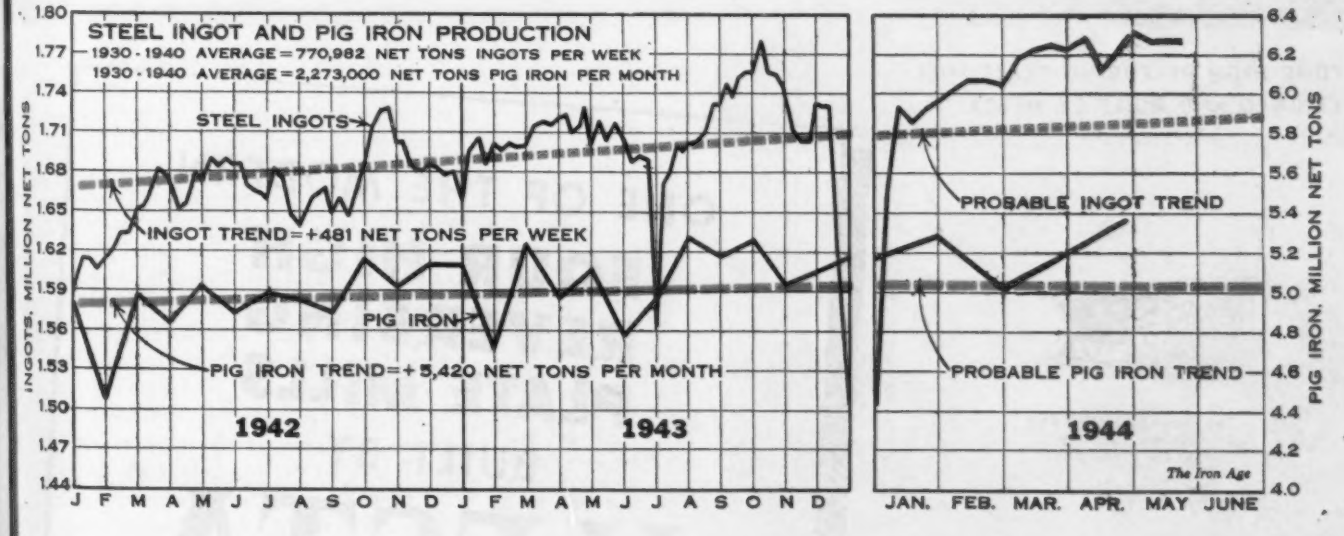
• **PIG IRON**—While no one is looking for a shortage in the near future several furnaces have been forced off for repairs. This situation may leave iron supplies for the next few months "at balance." At Cincinnati labor shortages are said to be having an effect on the melt. Ford this week had a break through at one of its furnaces, which will necessitate about a month's shutdown. A Hanna furnace and a stack at Bethlehem's Buffalo plant have been down for sometime and relining completions are said to be indefinite because of lack of proper labor. Republic took a furnace off for relining last week at its Alabama Thomas Works while Tennessee Coal, Iron & R. R. Co. has one stack down for repairs.

• **CMP INVESTIGATION**—According to reliable reports the WPB will soon launch a full dress investigation of the authenticity of allotment numbers being used by steel consumers. It is said that there appears to be cases where allotment numbers are being furnished steel companies for more steel than has been allowed by WPB. It is physically impossible for steel companies to check up on their customers since they fill the orders as CMP numbers are furnished. At any rate, with tickets only being issued for a portion of the demands approved by WPB for the third quarter and with mills being filled up especially in the flat rolled field, it is said that strong measures will be taken to see if irregularities exist.

• **HOW MUCH SHELL STEEL**—Figures are flying thick and fast as to the amount of steel which will be used for shell steel over the next several months. Some semi official information leans towards 525,000 tons for the third quarter and a figure ranging from 615,000 tons to 825,000 tons in the fourth quarter. Roughly this ranges from an average of 175,000 tons a month in the third up to 275,000 tons a month in the fourth quarter. Some sources say the amount will be more than this but it is thought such opinion is being based on the belief that a further expansion in the shell program is in the offing soon.

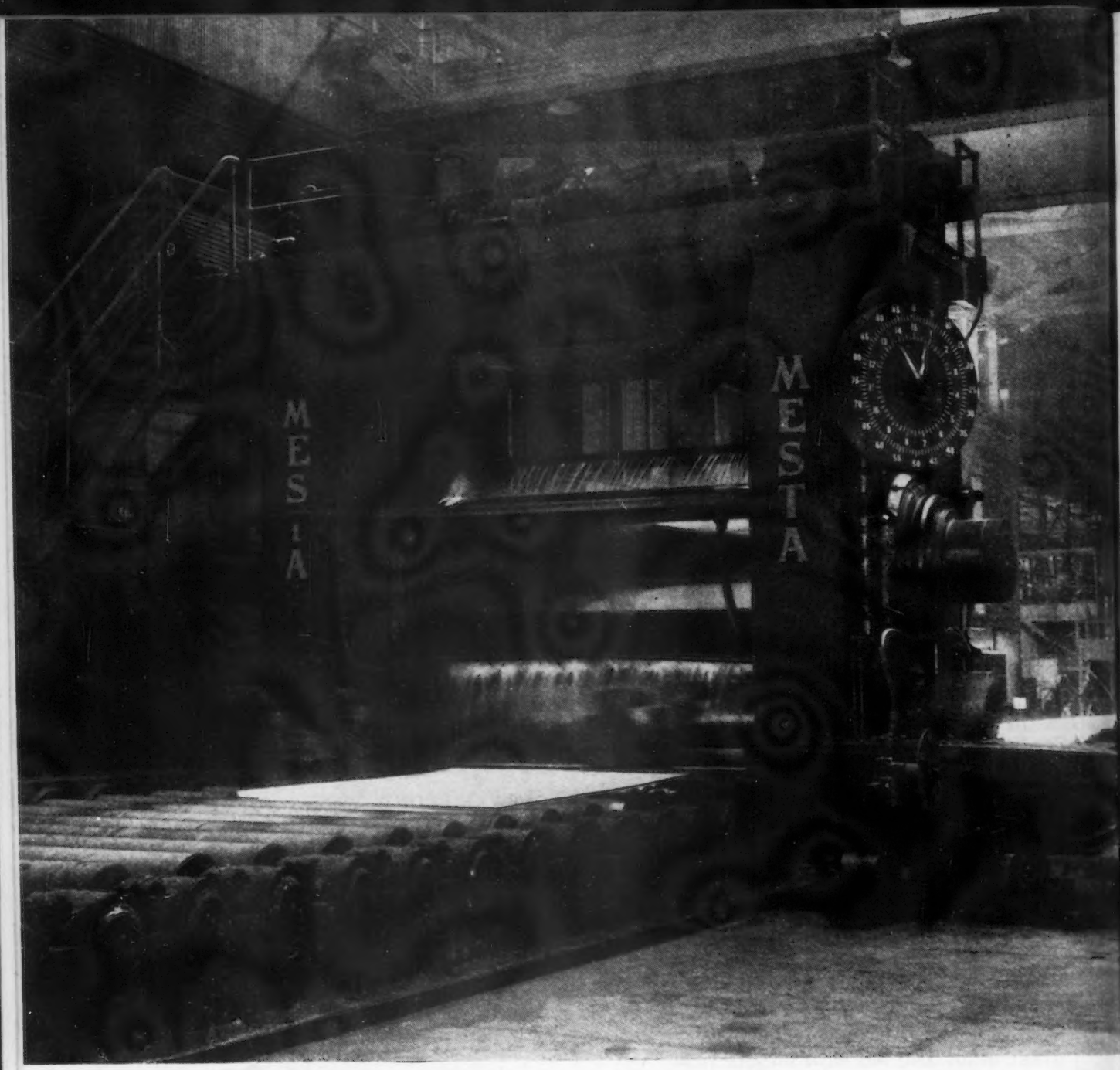
• **PLATE CUT BACKS**—Latest information says plate output for the Maritime in the third quarter will be about 435,000 tons a month but this is subject to change. It seems clear that the Maritime will get at least 100,000 tons more plates in the third quarter than was indicated when cutbacks were set up. This situation probably means that the flat rolled picture will show far less change in the third quarter than had been expected. Deliveries are more and more extended.

• **POSTWAR FRONT**—Whenever restrictions are lifted, it is understood one large electric refrigerator manufacturer has placed conditional orders for 70,000 cabinets. An eastern railroad system has placed provisional orders for 300 combination baggage passenger cars, with 20 to be constructed of aluminum, 153 with high tensile underframes and stainless steel exteriors, and 127 all stainless steel. Two oil field operators are said to be interested in possible use of landing mats for use as roads in marshy oil fields.



Steel Ingot Production by Districts and Per Cent of Capacity

Week of	Pittsburgh	Chicago	Youngstown	Philadelphia	Cleveland	Buffalo	Wheeling	South	Detroit	West	Ohio River	St. Louis	East	Aggregate
May 11	95.5	101.5	103.5	101.0	96.0	104.5	99.0	97.0	101.0	84.0	100.0	99.0	97.0	99.0
May 18	96.0	102.5	103.5	99.5	83.5	106.5	99.0	97.0	100.5	86.0	92.0	99.0	97.0	98.5



140" FOUR HIGH REVERSING PLATE MILL
DESIGNED AND BUILT BY MESTA

The Army-Navy "E" Flag
with four stars, flies
over the Mesta plant

ONE OF THE MODERN
FOUR HIGH REVERSING PLATE MILLS
BUILT BY
MESTA

MESTA MACHINE CO
PITTSBURGH, PA.

★ ★ LET'S ALL BACK THE ATTACK — BUY MORE WAR BONDS ★ ★

Postwar Markets, Renegotiation, Disposal of Surplus Machines Discussed by Machine Tool Builders

FRANK J. OLIVER,

Technical Editor

o o o

• • • **Allowing** the machine tool industry to begin the manufacture of machine tools for some postwar civilian use will permit the industry to better meet the sudden and varied demands of the armed services was the contention of James Y. Scott, president, Van Norman Co., in addressing the spring meeting of the National Machine Tool Builders Association, of which he is president. Permitting the industry to operate on a higher level than it has would better enable it to absorb upturns in service orders such as have occurred in recent weeks, Mr. Scott said. Besides, such a procedure would ease the transition from war to peacetime work and would result in the least employment dislocation.

Reviewing recent changes in the industry, Mr. Scott indicated that most machine tool builders had scaled down machine tool operations last fall in line with an estimated output of $325,000,000 in 1944 and had taken in enough subcontract work to make up the slack. Just recently, new and unexpected orders have raised this estimate to close to $500 million but the industry is not prepared to step up its output at once since it cannot interfere with delivery commitments made on war subcontracts. The fact that pool orders are "out" only adds to the difficulty, since it makes planning for an unknown volume of new business almost impossible.

Looking forward to the postwar period, Mr. Scott pointed out that despite all the efforts made toward the redesign of machine tools to hasten the obsolescence of present equipment, the industry cannot expect to keep all its facilities occupied with the manufacture of machine tools in the postwar period. He suggested two courses of action: Cut down plants, facilities and operations to fit each company's estimate of postwar machine tool demand, or add a new product to the sales line. Although he cautioned about getting too far afield into the manufacture of consumer goods, neverthless he pointed out that the nearer a product came to the field of consumer merchandise, the more it might help to offset the

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• *On the north bank of the Chialing River near Chungking, China is the iron and steel plant of the China Industrial Co. It is the Hsiang Kuo Shi Works. This is a major Chinese source of steel for Chinese armaments.*

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• *At this plant, unskilled labor is in the majority. Coolies here are facing firebrick for the steel plant refractories. Coolie labor is cheap and is one hindrance to the mechanization and industrialization of China.*

o o o

• *Hsiang Kuo Shi Works was designed and constructed by Chinese engineers and workmen. The plant is one of the most modern in China and has a rated capacity of about 700 tons of steel ingots per month.*

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tremendous cyclical variations in machine tool demand.

Cost cutting is going to be the paramount problem of postwar manufacturing and Mr. Scott saw a good opportunity for the machine tool industry to do a real selling job in this regard. "Is it heresy to suggest that new machine tools might even help cut the costs of war production and thereby lessen the expense to the taxpayer?" he asked also. In this connection, he pointed to a trend toward the use of process machine tools as against operational machine tools. A process machine tool was defined as one that would take a unit and move it through a cycle of 20 to 30 different operations and turn out a finished product. Where production warrants, this type of machine will be in demand because of sustained high labor costs.

Other speakers at the NMTBA meeting held in Cleveland on May 8 and 9 touched on such subjects as renegotiation, disposition of government owned machine tools, sales and service policies and OPA price controls. Harold T. Johnson, director of the standards section, General Motors Corp., repeated the talk on machine tool electrical and mechanical shortcomings given before a private session in Detroit a few weeks before (THE IRON AGE, May 4, p. 78). J. G. Bates, time and motion study engineer of GM, exhibited a motion pic-

(CONTINUED ON PAGE 158)

New Action by Renegotiation Board Denies Exemption on Standard Articles

Washington

• • • **The War Contracts Price** Adjustment Board has announced a policy that no request for exemption from renegotiation of contracts and subcontracts for the making or furnishing of a standard commercial article will be granted for 1943 unless competitive conditions affecting the sale of the article in 1943 were such as would reasonably protect the government against excessive prices.

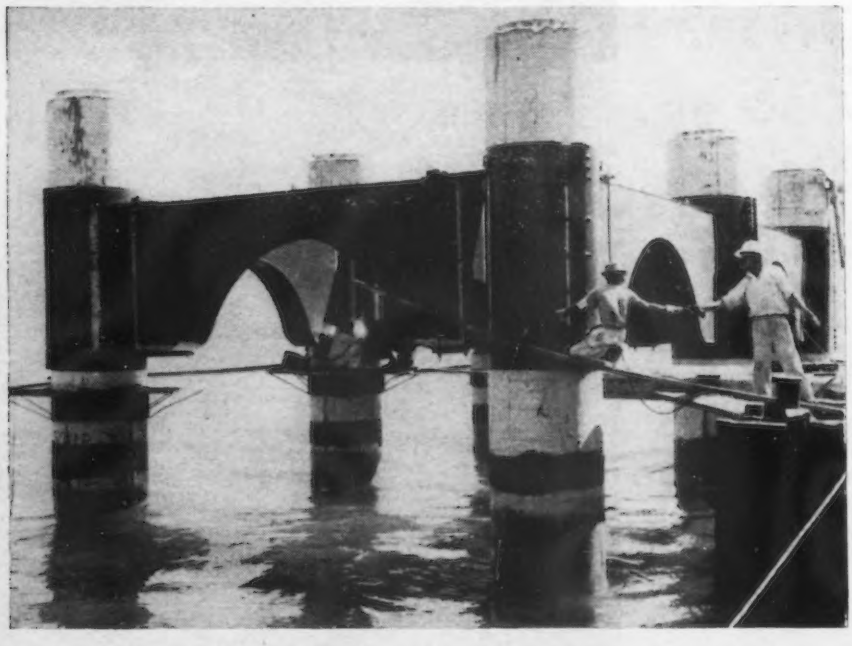
This announcement was made by the board as it denied applications for exemption from renegotiation of numerous articles under the standard commercial articles provisions of the Renegotiation Act. Among the articles affected were bucket loaders, portable belt conveyors, clamshell buckets, aircraft bolts and screws, bolted steel and wood tanks, .22 caliber rifles and spare parts and accessories. Also denied were requests for exemption of general hardware sold at wholesale and metal stampings. At the same time the board denied requests for the exemption of products made from ferrous and non-ferrous scrap, as well as requests for the exemption of containers for exempt raw materials and agricultural commodities.

"Competitive conditions affecting the sale of such articles," the board said, "are not such as will reasonably protect the Government against excessive prices so long as excessive profits are being realized by any significant segment of the industry making or furnishing such article. Therefore, in the case of any standard commercial articles with respect to which excessive profits were realized in 1942 in the industry making or furnishing such article, a request for exemption will not be granted by the board unless it is established that excessive profits were not realized in this field in 1943.

"In view of the announced policy of the War Contracts Price Adjustment Board to the effect that renegotiation proceedings will not be delayed by reason of the fact that an application for exemption of a standard commercial article has been or may be filed, the board has determined that all applications for such exemptions relating to fiscal years ending on or before July 1, 1944, are to be filed with the board on or before June 1, 1944."

The board has determined more than 100 so-called "raw material products" to be exempt. In interpreting and applying the raw material products exemptions, the board said that such products "are exempt only when they represent products of a mine, oil or gas well, or other mineral or natural deposit, which have not been processed, refined or treated beyond such first form or stage suitable for industrial use and are not exempt if manufactured from raw materials which do not fall within the above description or which have at some prior stage been processed, refined or treated beyond such first form or stage suitable for industrial use. For example, magnesium products derived from seawater, products manufactured from the atmosphere, secondary aluminum pigs and ingots, and other similar products are not considered exempted products."

OIL WELL: *Twin wells will eventually be drilled from this completed derrick foundation on Lake Maracaibo, Venezuela. Gulf, Shell, Standard and many other companies have completed techniques for drilling wells under bodies of water, and Shell has done considerable development work in this area.*



Shell Plant Capacity Doubled

Birmingham

• • • **Capacity of the shell** forging plant of the Tennessee Coal, Iron & Railroad Co. here will be doubled. The plant recently produced its three-millionth 155 mm. shell.

Kaiser Tells of Shell Contract; Fontana Progress; and Postwar Plans

By DONALD C. MacDONALD
Cleveland Regional Editor

Cleveland

• • • **Henry J. Kaiser**, West Coast miracle man of industry, told of the plans and considerations entering into his acceptance of a $25,000,000 heavy caliber shell contract; revealed for the first time the progress of his new Fontana, Cal., steel plant; and discussed his policies for postwar planning and manpower acquisition.

Backed by his famous reputation for "getting things done," Kaiser, with a steel plant that has had only a brief run of actual production and is not yet entirely completed, has undertaken a top urgency contract to produce several hundred thousand shells. Despite some doubt in Washington that his facilities were adequate, this belief was disproved which resulted in the maintenance of the already let contract.

Mr. Kaiser pointed out that the annual steel capacity of his plant is now rated at more than 720,000 tons. Plate, up to the moment, has been the only rolled product of the plant and the mill has been producing an average of more than 31,000 tons of this product per month, although only rated at about 25,000 tons per month. Shell steel capacity is estimated at about 20,000 tons per month.

Rolling equipment which has up till now consisted of only a plate mill which rolled directly from bottom cast slab ingots will be augmented by a 36-in. break-down mill within the next two or three weeks. This mill will roll the shell steel billets for the still to be added shell forging equipment. Rough turning of the shell forgings will be done at Fontana.

Temporary buildings from a nearby location are being moved onto property adjacent to the Fontana plant to house the new shell forging and rough finishing equipment. The finished machining of the shells will be done in a recently acquired Denver, plant. The total expenditure for 600-ton forging presses, rough turning equipment, heat treating furnaces and finishing machine tools is estimated at about $10,000,000.

All of this equipment, part of which the Kaiser organization has located around the country already built but never installed, will be in partial production by early fall and full production by year end according to plans.

Questioned on the availability of sufficient shell steel capacity, Mr. Kaiser pointed out that ample tonnage appeared to be in sight since plates were only taking slightly over half the plant's ingot capacity and since plenty of room was available to them to permit the use of large areas for hot topping and slow cooling required by shell steel. Mr. Kaiser also stated indirectly that plate tonnage should not be any particular consideration as there were a number of reasons to believe that plate demand would decline some in the future.

He also pointed out that the Homestead plate mill of the Carnegie-Illinois Steel Corp., the new plate mill at Provo, Utah, and the mill of Sheffield Steel at Houston, Texas, would soon be increasing the nation's capacity.

Exploding the rumor of some months ago that the Fontana mill was built with only a single year's ore supply located nearby, Mr. Kaiser said that the present supply was good for at least seven years and disclosed that he had recently purchased an ore lode, estimated at approximately 100,000,000 tons by the Bureau of Mines, from the Southern Pacific. This ore is located approximately 150 miles from the plant and can be mined by open pit methods.

When asked about raw material costs, he stated that his present ore was costing him about $2.18 per ton which is a decided drop below the Great Lakes prices of over $4. Mr. Kaiser said that he still was not satisfied with his ore costs, however, and intended to get $1 per ton ore from his new lode when it was developed. Limestone is costing an infinitesimal amount, a company representative said, since it is shipped only nine miles to the plant.

The plant's highest cost raw material appears to be coke which is believed to be costing in the vicinity of $9 to $10 per ton. However, Mr. Kaiser emphasized that actual coke costs were hard to estimate at this time due to uncertainties existing regarding the sale and value of by-product chemicals.

A company representative commented that mill operating costs were getting down to a surprisingly low level since most of the operating kinks have been ironed out and it is suggested that Kaiser's steel plant may one day offer very real and economically feasible competition for eastern producers.

INVASION PREPARATION: *Specialists of the U. S. Army will go in under fire in the initial assaults on the beachheads of Western Europe to provide all types of supplies for the invading forces. This 1½ ton truck during invasion maneuvers backs into a huge landing barge to help unload its cargo. Some idea of the beating taken by packagaing materials is given by the broken packing cases.*

CONESTOGA: *Called the Conestoga after the amazing vehicle that helped pioneer the settlement of colonial territories west of the Alleghenies, this "flying box car" is now in full production, and will be used by the Navy in practically all war theaters.*

Budd Begins Full Scale Production of Stainless Steel Airplanes for Freight and Transport

Philadelphia

• • • **A new air cargo** plane, known officially as the "Conestoga" in tribute to the amazing vehicle which helped pioneer the settlement of colonial territories west of the Alleghenies, has been put into full scale production by the Edward G. Budd Mfg. Co., in its new airplane plant near Bustleton, on the outskirts of Philadelphia.

The cargo carrier is of a brand new type which utilizes welded stainless steel instead of riveted aluminum alloy sheets for the first time, on any considerable scale, in the history of the design of military and commercial aircraft. As such, aeronautical engineers believe there is a strong possibility that the new plane will exercise a major influence on the character of air transports in the future.

The Budd cargo plane was designed by a staff of Budd engineers directed by Dr. Michael Watter, a veteran airplane designer with a number of famous craft to his credit. It was developed under sponsorship of the Navy Department, Bureau of Aeronautics, and is being built under a Navy Department contract.

The cargo plane was brought into being to provide a type that could be used on routes in South America, where unimproved fields and short runways are common. Since its development, however, the uses to which the military services plan to put the airplane have broadened to such a degree that it is now expected it will be used on military air cargo routes in practically all theaters of the war.

DRIVE IT IN!: *In addition to cargo that can be moved mechanically into the ship, there is provided a specially designed hoist fitted above the loading ramp and a manually operated winch mounted on the forward end of the cargo compartment. Here, the "duck" is being driven up the ramp into the plane.*

Announcement of the Budd stainless steel cargo plane appeared in THE IRON AGE, *Nov.* 6, 1941, *page* 93. *Other references to the Budd and other stainless steel aircraft appeared in* THE IRON AGE, *Oct.* 30, 1941, *page* 62; *Nov.* 11, 1943, *page* 45; *June* 24, 1943, *page* 44; *and Feb.* 3, 1944, *page* 43.

The plane was designed specifically to be a cargo carrier. In creating the plane, the engineers centered their efforts on the problem of designing a "flying box car," which could carry freight economically on flights of moderate length, and also be capable of loading and unloading cargo with utmost ease and speed.

The plane is a two engine transport 68 ft. long, with a wing spread of 100 ft., and is capable of transporting 10,400 lb. of cargo over a range of 650 miles under A.C.A.A. license. Its 14 cylinder radial air cooled engines deliver 1200 hp. each

for take off and have a normal rating of 1050 hp. Having in mind the types of airports from which it might be forced to operate, the designers provided that the plane should be able to get onto and take off from short landing strips, even with heavy loads. In tests the plane demonstrated that in normal operation it could lift 10,400 lb. of payload off a landing strip in a run of 920 ft.

Aside from its type of construction and unique appearance, the plane's most distinguishing characteristics are its provision for carrying cargo and a ramp to facilitate its loading and discharge. The cargo compartment is a space 25 ft. long, 8 ft. wide and 8 ft. high wholly unobstructed by structural members. The plane is equipped with a large cargo hatch in the underbody. This hatch may be lowered to form a ramp to the surface of the landing field, or a loading platform level with the platform of a truck. Back of it are two large clearance doors which may be lifted out of the way to provide the necessary headroom to utilize the 8-ft. square cargo compartment.

The upward sweep of the afterbody of the plane provides a large clearance below the fuselage and back of the ramp to allow trucks to be moved close to the fuselage so as to pick up or discharge shipments. Provision is made for handling cargo with the aid of a specially designed hoist fitted above the loading ramp, and a manually operated winch mounted on the forward end of the cargo compartment. These permit the loading of large, heavy pieces of freight, machinery or motor transport. Both an ambulance and a jeep can be rolled into the cargo space at once and still leave a large space for stowage of other cargo. Because of the tricycle landing gear, on the ground and in the air the floor of the cargo compartment remains horizontal, obviating the necessity of hauling freight up an inclined floor.

The unusually large cargo space is made possible through a unique design for the attachment of the wing to the fuselage. The wing structure does not pass through the fuselage in conventional fashion. Instead, Budd designers, through a novel arrangement of the fuselage, were able to attach the wings to five special side frames joined across the body by shallow but rigid transverse members, thus providing headroom of 8 ft., or 2.5 ft. more than that possible with conventional structure.

Although primarily a cargo carrier, the plane can be converted to troop transport or to aerial ambulance use. Provision is made for installation of 24 seats and 24 stretchers. Doors in opposite sides of the fuselage permit launching of paratroops from both sides simultaneously, and provision also is made for the discharge of cargo (or paratroop supplies and equipment) by parachute through the opened clearance doors in the aft portion of the body.

The plane requires a crew of two, a pilot and a co-pilot, whose quarters are in a full height operating compartment in the nose of the plane. Dual controls are installed, as well as remote control radio and facilities for blind landings and take offs.

HEAVY CARRIER: *The upward sweep of the afterbody permits high clearance beneath the fuselage. The tricycle landing gear keeps the plane in flight position, and eliminates many storage problems. It will carry an ambulance and amphibious "duck" as shown here, and still leave a large space for stowage of other cargo.*

The effective way in which stainless steel has been used in aircraft design in the Budd plane is disclosed by the fact that although the total weight of plane and full load is 33,800 lb., 10,400 lb. represents the weight of cargo.

With a full load, including equipment, fuel, and the crew, the plane at a cruising speed of 165 miles per hr. will have a range of better than 600 miles. The maximum range with available fuel tankage will be about 1700 miles. This can be increased to 3500 miles with auxiliary fuel tanks.

The cruising speed is around 165 miles per hr. At this speed the two engines each will deliver 710 hp.

STAINLESS CARGO PLANE: *The first large size airplane made of stainless steel is now undergoing flight tests. This ship, designed by the Edward G. Budd Mfg. Co., is a Navy project.*

Army Ordnance Spare Parts Program Reported 20 to 70 Times That of Germany

Cleveland

• • • **The little heralded** Army Ordnance spare parts program is big business for steel fabricators and steel producers. Misunderstanding, however, originates from its immense and mainly unexplained size when contrasted with Germany's spare parts program. Depending upon the part, our program is reported to be from 20 to 70 times larger than that of Germany.

Many prime contractors can testify that at least 40 per cent of their business is concentrated upon spare parts, mainly for the end product they are making. Ordnance is struggling with the task of supplying over 350,000 individual kinds of parts for the servicing of more than 550 different types of vehicles. Cleveland Ordnance District alone last year reported production of $120,000,000 in spares. Willys-Overland Motors, Inc., Toledo, is reported to be producing 100 carloads of spare parts monthly for the Jeep which they also make. One parts storage building in Texas is said to have 167,000 bins for storing separate spare parts and another in England is said to have 320,000 bins. The program is immense; spare parts may some day be a large portion of the estimated $50 billion in surplus material expected after the war.

Having actively planned war for at least eight years prior to its outbreak, Germany working under a regimented economy standardized war equipment so far as possible at that time. A single type of tank engine drove all tanks; and trucks, guns, vehicles of all types were similarly standardized with many parts made interchangeable. Hence, parts requirements were minimized.

By contrast when America entered the war, Ordnance set about to make the equipment and vehicles with existing tooling. Consequently, several widely different and competitively made trucks were adopted. There was no standard tank engine, and medium tanks were built by different concerns with four different engines. Spare parts had to be maintained for all four types. The same happened with the trucks, trailers, motor cycles and many other pieces of equipment which were built from what was on hand rather than what could be designed if there was complete war planning.

Industry, particularly the automotive firms, is not heartily understanding of the lack of standardization as it is believed that standardization could have been achieved during the conversion of the auto plants. However, with the military not being sure that there was time to attempt standardization, due to the unknown course of the war at that time, the failure of Ordnance to take such steps has not been too severely criticized and the burden of making thousand of tons of spares along with regular production has been taken in stride. The same flexibility that was offered to make standardization possible in the beginning has come in to good advantage in making the frequent and sometimes drastic model changes, thus helping put American equipment ahead of any enemy equipment in the war.

"Basic" Steel WLB Wage Panel Sketches *(Left to Right)*

HUGH MORROW (Industry) — President of Sloss-Sheffield Steel & Iron Co., Birmingham; director of Southern Railway Co. and American Iron & Steel institute; president, Alabama Mining Institute.

EDWIN D. BRANSOME (Industry) — President of the Vanadium Corporation of America; 1913 to 1917, partner, Reid - Waples & Co., Philadelphia contractors; 1919 to 1921, General Motors Co., New York, 1921 to 1930, general manager, Wilson Welder & Metals Co.; 1930 to 1935, coordinator of business relations, Air Reduction Co., Inc., New York.

N. P. FEINSINGER, Vice-Chairman (Public) —WLB's Disputes Division Director; former chairman WLB Trucking Commission; college professor (on leave) University of Wisconsin Law School.

DAVID L. COLE, Chairman (Public)—Attorney and public member of the New York Second Regional War Labor Board; Chairman of the New Jersey State Board of Mediation; 1941-42, president of the Paterson, N. J., Fair Rent Commission.

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JOHN DESPOL (Labor) —CIO-USWA International Representative, Pacific Coast, lawyer; LLB University of Oregon.

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STEPHEN LEVITSKY (Labor) — CIO-USWA International Representative, and USWA charter member.

Surplus War Property Ruling Sets up List of Selling Agencies

Washington

• • • **W. L. Clayton**, Surplus War Property Administration head on May 12 announced the issuance of SWPA Regulation No. 1 governing declaration of surplus property by the Army, Navy and the Maritime Commission. Included in the regulation is a list of selling agencies, the locations of regional offices and the Standard Commodity Classification showing what property is to be handled by each selling agency.

The regulation adds three new selling agencies to the five recommended by the Baruch-Hancock report. Agencies now authorized to sell property are: Procurement Division, Treasury; RFC; Maritime Commission; FWA; FEA; NHA; WFA, and the Navy Department.

Selling agencies will be held responsible for all the property turned over to them. They are to determine methods of sale, the identity of purchasers and price, and execution of all documents in connection with disposal.

The Army, Navy and Maritime Commission are permitted to sell termination inventories, and nominal quantities. Also, these agencies which have the duty of declaring goods surplus, may withdraw such property as they desire even after they have declared the property to be surplus.

The regulation provides that sale or other disposal of surpluses in active theaters of operation may be made by the military or naval commanders. Pending further regulations the Army, Navy and Maritime Commission are authorized to sell surplus property in those areas abroad where FEA, has no local office, and in any of the territories and possessions of the United States where the appropriate selling agency has no representative.

Standard forms, using the Standard Commodity Classification Code, have been provided for agencies to report surplus property to the regional office of the selling agency for the territory in which the property is located.

The selling agencies and the categories of property assigned to them follow:

1—Procurement Division: — Consumer goods.

2—RFC (which may act directly or through any of its subsidiary corporations): — Capital and producer goods. Industrial real properties of every kind, buildings and fixtures, except real property assigned to the Maritime Commission, NHA, and FWA. Personal property, machinery and other equipment, materials and products finished or in process reported by agencies in conjunction with the plant which can be disposed of as a unit.

3—Maritime Commission: — Maritime property. Real property such as ship yards, repair yards, marine terminals and similar property, including fixtures. If this property cannot be sold to be used for building, repair or operation of shipping, it is to be turned over to RFC. Ships of commercial design, or which can be converted into commercial use.

4—Navy Department: — Combat ships or naval auxiliaries.

5—War Food Administration:—Food.

6—National Housing Administration:—All housing except that under control of the War and Navy Departments.

7—Federal Works Agency:—Facilities financed by FWA not located on NHA projects.

8—Federal Economic Committee:—All property abroad, including property in territories and possessions.

Subsequent regulations will be issued to cover property not governed by Regulation No. 1, particularly real property other than those types of real property now assigned to RFC, Maritime Commission, NHA and FWA. Meanwhile agencies not covered by the regulation will continue to follow established procedures on unassigned property, keeping SWPA advised of plans, policies and procedures.

Oliver Iron & Steel To Make Large Sized Shells

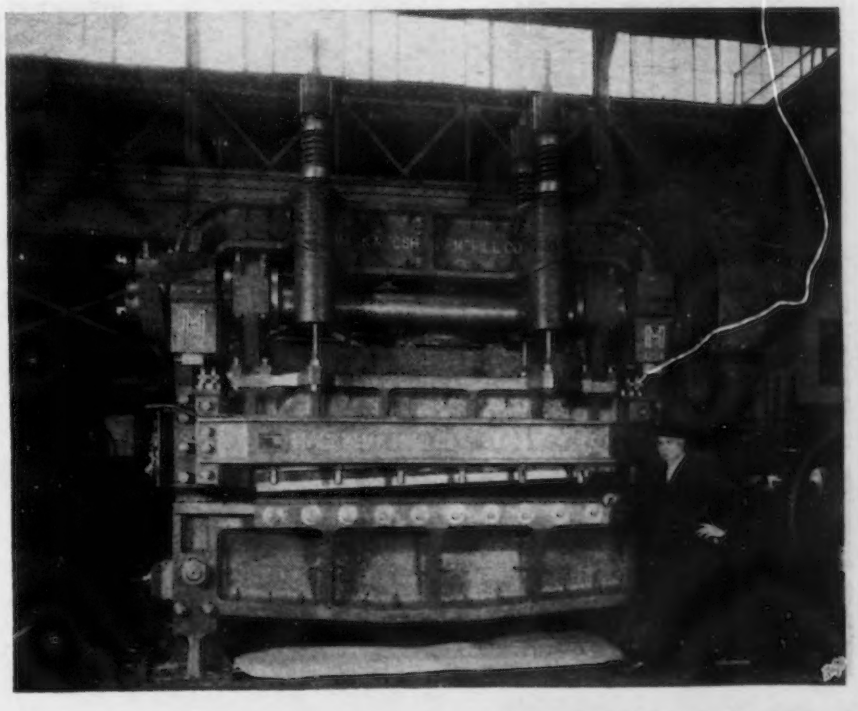
Pittsburgh

• • • **The Oliver Iron & Steel Co.** here has received an Army contract to manufacture large size shells, according to the company.

The company will install more than one million dollars worth of machinery and equipment in the idle West Pittsburgh plant of the Garland Mfg. Co., between New Castle and Beaver Falls, Ernest Schleusener, vice president in charge of operations, reported.

Oliver Iron & Steel has been manufacturing smaller size shells for the Army and Navy.

PLATE SHEAR FOR INDIA: *This 100-in. plate shear is ready to leave the plant of Mackintosh-Hemphill Co., Pittsburgh, for a steel plant in India. The shipment was arranged by the British Supply Mission. The shear weighs 55 tons and cuts plates up to 1 in. thick.*



Steel Warehousemen Discuss Surplus Stock Disposal and Pricing

Chicago

• • • **Availability of** steel for warehouse distribution, disposal and pricing of surplus stocks, and the long term future of the industry occupied the attention of the fifth annual meeting of the American Steel Warehouse Association, Inc., here last week.

Pinch hitting for Norman W. Foy, director of the WPB steel division, J. V. Honeycutt, former steel division official now returned to Bethlehem Steel Co., offered a personal and unofficial appraisal of the steel situation, involving much tighter supplies for the third and possibly the fourth quarters of 1944. After tracing remarkable production records of the steel, aircraft and shipbuilding industries, he recalled that the vital function of steel warehouse stocks had been driven home to the government in the second and third quarters of 1942 when depleted stocks threatened continuity of war production. In these warehouse "blues days," he recalled, it was often harder to secure delivery of 1000 lb. of a specialty item than 1000 tons because of reluctance of mills to change rolling schedules to produce the smaller quantity and the frequent inability of warehouses to fulfill their usual function in this regard. As a result, warehouses have received more abundant allotments in the past seven calendar quarters, and their future treatment should be good.

Honeycutt warned, however, that steel may be less abundant in the third and perhaps the fourth quarters of 1944 because of the impact of additional war requirements. "Five weeks ago, many thought the third quarter would see a letting up of pressure, particularly on flat rolled products. In the past two weeks, one of the large claimant agencies, which had previously indicated its demands would be reduced, has had to reinstate requirements for an additional 100,000 tons. This will mean that the industry cannot produce as many sheets as it had expected. It is probable that there will be a third quarter demand for all the carbon steel products which the industry can make."

The Bethlehem official classed flat rolled product as "still the tightest." He saw a possibility of change in the fourth quarter, when he felt that the Maritime Commission might require less plates. This would contribute to easing of the flat rolled situation and enable greater sheet production. As another potential factor, he cited the possibility of the shell steel program reaching 175,000 tons per month. If it reaches this figure, he declared that pressure would be heaviest on structural and rail mills.

Lt. Col. A. E. R. Peterka, chief of the materials distribution branch, Aircraft Scheduling Unit, Wright Field, Dayton, Ohio, said that details of a plan for disposal of surplus material should be available in two or three weeks for the aircraft industry. The probable pattern would include taking of inventory and segregation and inspection by the aircraft contractors, the usable material then being turned over to an unnamed government agency. This agency would supervise disposal through established warehouse channels, with details to be worked out with the industry. He emphasized that the government would be a partner rather than a competitor of the warehouses in redistribution of surpluses. The method chosen for disposal of aircraft surpluses may prove a pattern for the other services, he said.

Discussing the growth in the past six to nine months of "allegedly huge" aircraft surpluses, Col. Peterka said that in reality no one knows whether these surpluses are huge or not, but that steps are being taken to find out. He absolved the aircraft industry of blame in allowing these accumulations, and attributed them partially to hysteria over critical shortages a year ago, changes in production methods and design resulting in savings of material and contract termination. He cautioned against over emphasis on dollar valuation of these surpluses, because aircraft steel is the highest price per ton, thus leading to possible overestimate of quantities.

Robert E. Kinkead, consulting welding engineer, Cleveland, speaking on "30,000 New Warehouse Customers," described a vast new sales reservoir which the warehouses could tap by furnishing "cut to size" components of common industrial devices, together with welding and assembly instructions in simplified form, for use by small workshops.

E. L. Wyman, head, steel warehouse and surplus materials section, OPA, discussed Amendment No. 23 to Revised Price Schedule No. 49, issued the previous day, setting up a separate schedule for sales of surplus iron and steel. He expressed the belief that the bulk of current transactions come well within the ceilings enacted inas-

U. S. STEEL MEETING: *Irving S. Olds, chairman of the board of U. S. Steel Corp., told stockholders at the annual meeting recently that U. S. Steel had agreed to act without compensation in an advisory capacity to assist the Navy Department in solving complex problems involved in distributing combat equipment.*

much as they principally concern special grades for which the full price usually is not realized on resale. The OPA, he said, is more interested in the smaller proportion of items in great demand. The agency's concern is that the consumer pays no higher than its present reasonable price for steel, and it hopes to discourage speculation and encourage flow of material through normal channels. For this reason, he declared the schedule provides a separate higher price for products which have been put through the warehousing process than for those which have not.

J. R. Stuart, chief, Warehouse Branch, steel division WPB, classified the fundamental aims of the division under CMP, as applied to warehousing, and providing for the maintenance of adequate stocks, use of sufficient control so that steel will go to "the right places at the right time," and assuring the distribution organization of sufficient manpower, facilities and other necessities for operation.

Rather than arbitrarily maintaining the amount of steel distributed through warehouses at the approximate prewar figure of 14 per cent of mill production, Stuart said that WPB had decided to balance the amount given the warehouses with their customers' actual requirements. It was decided first to establish adequate stocks, then allow distributors to replace what they sold. Today, he declared, receipts of material by the warehouses are approximately balancing sales, and in the first quarter of 1944, the industry handled one million tons, highest in its history. Ceilings established in relation to base tonnages in order to provide equitable distribution have proved no handicap, he stated.

Paralleling a previous statement by Walter F. Doxsey, association president, he described efforts made by WPB to have the steel warehouse industry declared essential under war manpower commission regulations, but held out little hope for success. He recommended that warehouses in critical labor areas band together to attempt to secure recognition through the area WMC office as locally essential.

At their annual business meeting the directors of the association re-elected Walter S. Doxsey, president; G. L. Stewart, Edgar T. Ward's Sons Co., Pittsburgh, and P. O. Grammer, of Grammer, Dempsey & Hudson, Inc., Newark, vice-presidents; and L. B. Worthington, U. S. Steel Supply Co., Chicago, treasurer.

April Steel Production Totals 7,568,530 Tons: Capacities Revised

• • • **April steel** production was lower than the March total because of the short month, but the average output per week in April exceeded average weekly output in any month of 1943, according to the American Iron and Steel Institute. A total of 7,568,530 tons of steel were produced during April, an average production of 1,764,226 tons per week.

As usual at this time of year, the Institute has revised figures for 1943 and for earlier months in 1944. The revised figures show that March output was 7,820,226 tons, or an average of 1,765,288 tons per week. The revised totals for March indicate a new record was set in that month, the total exceeding October, 1943, by about 6000 tons.

During April, 1944, the steel industry operated at an average of 98.5 per cent of capacity, which was the same as the revised rate for March. In April of last year, operations were at 99.3 per cent of capacity.

The figures before revision for 1943 and the first quarter of 1944 are shown in THE IRON AGE, April 13, 1944, page 100.

Production of Open Hearth, Bessemer and Electric Steel Ingots and Steel for Castings

Based on Reports by Companies which made 98.3 Per Cent of the Open Hearth, 100 Per Cent of the Bessemer, and 87.9 Per Cent of the Electric Ingot and Steel for Castings Production. Source: American Iron and Steel Institute.

1944

Period	Estimated Production—All Companies: Open Hearth Net Tons*	Open Hearth Per Cent* of Capacity	Bessemer Net Tons*	Bessemer Per Cent of Capacity	Electric Net Tons*	Electric Per Cent* of Capacity	Total Net Tons*	Total Per Cent* of Capacity	Calculated* Weekly Production all Companies (Net Tons)	Number of Weeks in Month
January	6,769,438	97.2	439,551	85.4	377,751	83.3	7,586,740	95.6	1,712,582	4.43
February	6,410,338	98.5	409,781	85.2	368,555	87.0	7,188,674	96.9	1,736,395	4.14
March	6,976,450	100.1	455,368	88.5	388,408	85.7	7,820,226	98.5	1,765,288	4.43
1st Quarter	20,156,226	98.6	1,304,700	86.4	1,134,714	85.3	22,595,640	97.0	1,738,126	13.00
April	6,768,895	100.3	437,517	87.8	362,118	82.5	7,568,530	98.5	1,764,226	4.29

Note—The percentages of capacity operated are calculated on weekly capacities of 1,572,755 net tons open hearth, 116,182 net tons Bessemer and 102,350 net tons electric ingots and steel for castings, total 1,791,287 net tons; based on annual capacities as of Jan. 1, 1944, as follows: Open hearth 82,223,610 net tons, Bessemer 6,074,000 net tons, Electric 5,350,880 net tons.

* Revised January through March, 1944.

1943

Period	Estimated Production—All Companies: Open Hearth Net Tons*	Open Hearth Per Cent* of Capacity	Bessemer Net Tons*	Bessemer Per Cent* of Capacity	Electric Net Tons*	Electric Per Cent* of Capacity	Total Net Tons*	Total Per Cent* of Capacity	Calculated* Weekly Production all Companies (Net Tons)	Number of Weeks in Month
January	6,576,788	97.8	478,161	85.9	369,573	95.5	7,424,522	96.8	1,675,964	4.43
February	6,031,605	99.3	447,810	89.1	345,189	98.8	6,824,604	98.5	1,706,151	4.00
March	6,787,902	100.9	503,565	90.4	383,111	99.0	7,674,578	100.0	1,732,410	4.43
1st Quarter	19,396,295	99.3	1,429,536	88.4	1,097,873	97.7	21,923,704	98.4	1,704,798	12.86
April	6,510,824	99.9	482,478	89.5	380,401	101.5	7,373,703	99.3	1,718,812	4.29
May	6,669,703	99.1	482,424	86.6	397,564	102.7	7,549,691	98.4	1,704,219	4.43
June	6,202,889	95.2	453,663	84.1	382,801	102.1	7,039,353	94.8	1,640,875	4.29
2nd Quarter	19,383,416	98.1	1,418,565	86.8	1,160,766	102.1	21,962,747	97.5	1,688,144	13.01
1st 6 months	38,779,711	98.7	2,848,101	87.6	2,258,639	99.9	43,886,451	98.0	1,696,423	25.87
July	6,556,794	96.8	466,345	90.6	384,737	91.9	7,407,876	96.2	1,675,990	4.42
August	6,700,118	98.7	484,847	94.0	401,499	95.7	7,586,464	98.3	1,712,520	4.43
September	6,646,968	101.4	480,757	96.4	386,614	95.4	7,514,339	100.7	1,755,687	4.28
3rd Quarter	19,903,880	99.0	1,431,949	93.6	1,172,850	94.4	22,508,679	98.4	1,714,294	13.13
9 months	58,683,591	98.8	4,280,050	89.5	3,431,489	98.0	66,395,130	98.1	1,702,439	39.00
October	6,892,029	101.6	513,585	99.5	408,503	97.4	7,814,117	101.2	1,763,909	4.43
November	6,543,204	99.6	440,878	88.2	387,893	95.5	7,371,975	98.6	1,718,409	4.29
December	6,502,980	96.0	390,979	75.9	361,185	86.3	7,255,144	94.2	1,641,435	4.42
4th Quarter	19,938,213	99.1	1,345,442	87.9	1,157,581	93.1	22,441,236	98.0	1,707,857	13.14
2nd 6 months	39,842,093	99.0	2,777,391	90.8	2,330,431	93.7	44,949,915	98.2	1,711,074	26.27
Total	78,621,804	98.9	5,625,492	89.1	4,589,070	96.7	88,836,366	98.1	1,703,804	52.14

Note—The percentages of capacity operated in the first 6 months are calculated on weekly capacities of 1,518,621 net tons open hearth, 125,681 net tons Bessemer and 87,360 net tons electric ingots and steel for castings, total 1,731,662 net tons; based on annual capacities as of January 1, 1943, as follows: Open hearth 79,180,890 net tons, Bessemer 6,553,000 net tons, electric 4,554,980 net tons. Beginning July 1, 1943, the percentages of capacity operated are calculated on weekly capacities of 1,531,789 net tons open hearth, 116,494 net tons Bessemer and 94,667 net tons electric ingots and steel for castings, total 1,742,950 net tons; based on annual capacities as follows: Open hearth 79,867,450 net tons, Bessemer 6,074,000 net tons, Electric 4,935,960 net tons.

* Revised January through December, 1943.

Steel Wage Demand for Taxes Attacked by Steel Research Adviser

Washington

• • • **USWA contentions** that steel workers should be given wage increases to compensate for increased war taxes and the purchase of war bonds were vigorously attacked on May 16 by Dr. Jules Backman, Steel Case Research Committee adviser.

Dr. Backman characterized as "devious" and "obscure" the argument of the union that the federal revenue laws impose burdens amounting to wage cuts on wage earners while continuing special privileges to high income groups.

Pointing out that in these days federal income taxes serve two purposes: (1) to raise money to help pay for the war; and (2) to siphon off excess consumer buying power and thus relieve the upward pressure on prices, Dr. Backman said: "Both of those purposes would be defeated if wage increases were granted to workers commensurate with increases in taxes upon their incomes. There cannot, therefore, be any sound basis for the proposition that the steel workers are entitled to increases in their wages to compensate for increases in taxes upon their income."

Making the point that it is not the function of WLB to say upon whom the tax burden shall fall, Dr. Backman said that this is the function of Congress and that WLB cannot "cannot presume to place its judgment above that of Congress."

The increases of taxes upon the income of steel workers have not resulted in any deterioration in their economic position since the beginning of the war, Dr. Backman contended, and presented government figures to demonstrate this fact. He also placed in evidence additional official figures showing sharp wartime increases in the taxes of all income groups with steadily increasing percentages above the $5000 a year income group.

Dr. Backman said these figures showed "that there is no basis for the claim that the steel worker has had to bear an undue increase in federal taxes upon his income since the beginning of the war as compared with other groups."

On the contrary, he asserted that taxes have been increased sharply for all groups, and declared that it is indeed a strange concept to describe as an increased burden the higher taxes which must be paid.

"It is even a stranger concept that such increases in taxes should be compensated for by higher wages," he added.

Dr. Backman told the panel that in its presentation the union has also implied that regular savings in the form of purchases of war savings bonds through payroll deductions are "to be considered as expenditures which reduce the standard of living."

Dr. Backman argued: "If any group is guaranteed that its earnings after the deduction of taxes must increase as much as living costs, then its living standard would be preserved at the expense of other groups. If bond purchases as well as taxes are deducted from earnings and the remaining earnings still increase sufficiently to compensate for increases in living costs the groups finding themselves in that fortunate position will have improved their economic status to the extent of their war bond purchases. Such groups will be able to command the same volume of goods and services as before the war and at the same time to add to their accumulated savings.

"Moreover, acceptance of the union's argument would mean that a further increase in wage rates would become necessary in order to compensate labor for further savings made in the form of bond purchases. Similarly, if increases in wage rates shall be granted to compensate for increased taxes, one of the primary purposes of the tax program will have been defeated, that purpose being to drain off excess purchasing power."

ENGINE LAB: *The Aircraft Engine Research Laboratory in Cleveland is reputed to be one of the world's outstanding laboratories of its kind for conducting research on present types of planes and for investigating new types of aircraft propulsion systems. These are the guide vanes in the altitude wind tunnel at the laboratory.*

Frozen Inventory to Be Factor in Postwar Era

Chicago

• • • **Indicative of the** possible speed with which durable consumer goods may hit the market upon lifting of restrictions is an inventory item of $950,000 in the 1943 annual report of Electric Household Utilities Corp., Chicago, representing finished washing and ironing machines, materials, and parts in process. The company, which markets under the trade name "Thor," points out that WPB restrictions forbid civilian sales of washers and ironers and that this inventory must be considered non-current until the restrictions are lifted. A net profit of $452,149.50, after taxes and depreciation, was earned in 1943.

OPA Sets Ceiling Prices on Sales Of Surplus Iron and Steel Products

Washington

• • • **To speed the flow** of excess stocks of iron and steel products that may be disposed of in substantial volume as the heavy production phase of the arms program nears its completion, OPA announced specific ceiling prices for transfers of such excess supplies. The new ceilings become effective June 1, 1944.

Iron and steel products which may be offered for sale by war goods manufacturers include bars, sheets, plates, strip, pipe and tubular products, fencing, barbed wire, nails and other merchant trade products.

The new maximum prices for sales and resales of excess stocks are designed to (1) aid the smooth and orderly flow of such supplies from holders to users or resellers, (2) to permit disposal with the least clerical burden to the holder releasing material for sale, and (3) to make available to the producers of civilian goods the excess stocks in the hands of arms producers, at prices comparable to those he would pay to his normal supplier.

By rigid provisions governing sales by resellers of excess stocks of iron and steel products acquired from holders, OPA expects to prevent acquisition of such stocks for speculative holding or sale. Exempted from all price control, however, are transfers of material from contractors or subcontactors to the government or its agencies, due to cancellation of government contracts.

Ceiling prices for other transfers are provided as follows:

1. In sales of iron or steel products by a war equipment manufacturing plant or other similar holder, maximum prices are established as the basic mill ceiling price to a consumer, plus freight from the governing mill basing point to the holder's location of material, plus actual transportation costs to the buyer's destination, adjusted for quantity and quality differentials.

There is this one exception: Exempt from price control are sales by a war equipment manufacturing plant or similar holder to a distributor for resale if the seller has not received a firm bid from a civilian goods producer or other similar buyer offering to pay the full maximum price for the material for use.

This pricing procedure is designed to place consumers and resellers on an equal footing in competing for excess stock. The exemption feature, OPA added, will relieve holders from the burden of determining maximum prices where consumers are not interested in bidding for the material, and at the same time enable the government and other holders to minimize losses on excess stocks sales. Fair prices to ultimate consumers are guaranteed, despite the exemption, by the fact that the reseller may not resell any excess stock purchased by him at more than the ceiling prices already established for warehouse and jobber sales of iron and steel products.

2. In resales of excess stocks of iron and steel products by distributors, the following ceilings are provided:

a. Ceiling prices shall be the basic mill price plus the customary warehouse or jobber markups provided that the material has been purchased for resale in substantially the same form as received and has been removed after the purchase from the holder's location; that it has been delivered, before receipt of any order to the warehouseman's or jobber's established premises, and that the material has been put through recognized warehousing operations.

b. For unwarehoused material, the ceiling price is the mill base price plus rail freight from the governing basing point to the place where the buyer requires the material for use, adjusted for quantity and quality differentials.

"Excess stock" of iron and steel products is defined as any iron or steel product purchased by the holder for use, but which he did not use, and now desires to sell. There is one exception: If the holder is both a manufacturer and a distributor of iron and steel products, any sale of a product which he normally distributes is not to be regarded as the sale of an excess stock.

A "holder" is defined as any person who buys an iron or steel product for use in manufacturing, and now wishes to sell material he no longer has need for. The United States Government and its agencies are defined as "holders" when they dispose of surplus materials.

Every seller of excess stock of iron and steel products is required to state clearly on the invoice that the material is excess stock. Every holder must mark on the invoice whether the material is being sold for resale. The seller's records as well as the invoice must adequately describe the material sold, so that the buyer can ascertain whether he is paying a legal price.

Holders wishing to dispose of excess stocks of iron or steel products are invited by OPA to use the facilities of the OPA district and regional offices for mill base prices and freight rates to be used in determining ceiling prices if they are not otherwise available to them.

This action was taken in amendment No. 23 to Revised Price Schedule No. 49—Resale of Iron and Steel Products. The provisions contained in the amendment governing sales of excess stocks supersede the provisions for "special sales" of "industrial materials" contained in Revised Maximum Price Regulation No. 204—Special Sales of Industrial Materials.

OPA Makes Changes in Pig Iron Ceiling

Washington

• • • **A change in the** pig iron price schedule which prohibits anyone from selling at prices higher than the maximum prices established in the schedule was announced by OPA. The new action, which became effective May 12, 1944, is intended to discourage speculative practices which would increase the cost of pig iron to the ultimate consumer.

Until February pig iron was allocated by WPB and sales by producers were made directly to consumers. Since the discontinuance of the allocation program, however, there have been some cases in which persons have purchased pig iron for resale. Although the General Maximum Price Regulation applies to the sales of such resellers, its formulae for determining maximum prices cannot be used readily because no comparable sales were made in March, 1942, the regulation's base date for pricing.

The maximum prices established by Revised Price Schedule No. 10 for producers' sales of pig iron apply as well to sales by resellers. This action was taken in Amendment No. 9 to Revised Price Schedule No. 10.

Finished Rolled Steel Production Statistics

• • • **Capacity,** production and shipments of finished rolled steel products by producers representing 98.7 per cent of the total output of these products were released this week by the American Iron and Steel Institute. As announced in THE IRON AGE, May 4, 1944, page 153, the form in which these figures are presented has been changed. Actual shipments to the consuming trade and to members of the industry for further processing or conversion into other finished products are shown under the revised tabulation.

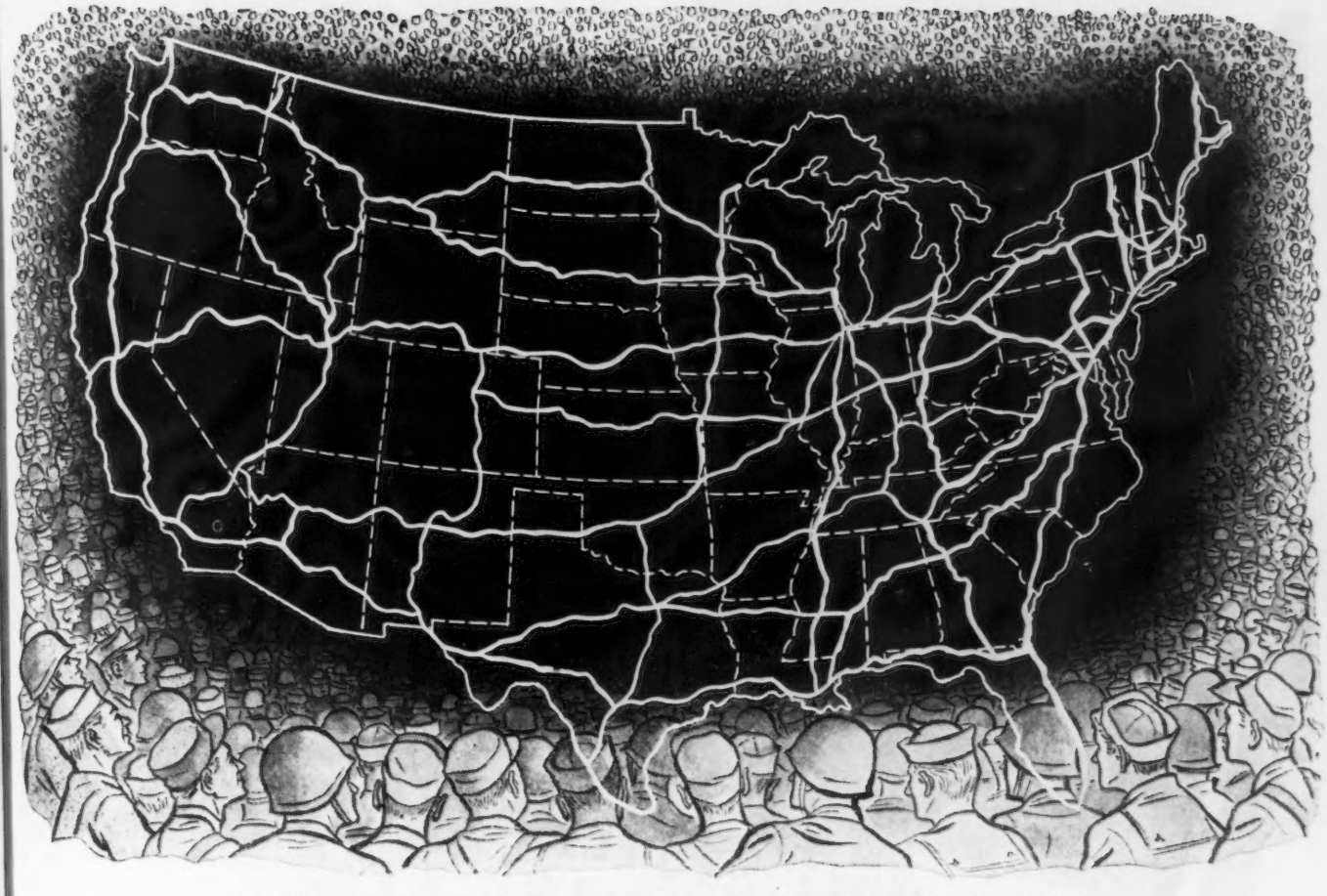
Shipments during March, 1944, were 102.4 per cent of the effective finishing capacity of the industry, totalling 6,146,595 net tons to consuming industries and 530,839 net tons to members of the steel industry for conversion into further finished products.

For the quarter ending March 31, 1944, shipments to consuming industries of rolled steel products totalled 17,614,955 net tons, while 1,525,276 net tons were consumed by the industry itself for further processing. During this period, shipments were 100 per cent of effective finishing capacity. Annual effective steel finishing capacity totals 64,722,000 net tons of finished rolled steel.

Of the 19,140,231 net tons shipped during the initial quarter of 1944, plates and bars took the biggest bite of the steel capacity, with sheet classifications trailing closely behind bars. A total of 3,457,871 tons of plate were shipped to consuming industries, chiefly the shipbuilding industry, and 123,645 tons were used by the steel industry for further conversion.

Capacity, Production and Shipments of Finished Rolled Steel Production for March, 1944, and Cumulative for the First Quarter, 1944. Source: American Iron and Steel Institute.

STEEL PRODUCTS	Maximum Annual Capacity, Net Tons	MARCH, 1944 Production Net Tons	Production Per Cent of Capacity	Shipments (Net Tons) Total	Shipments (Net Tons) To Members of the Industry for Conversion into Further Finished Products	TO DATE THIS YEAR Production Net Tons	Production Per Cent of Capacity	Shipments (Net Tons) Total	Shipments (Net Tons) To Members of the Industry for Conversion into Further Finished Products
Ingots, blooms, billets, tube rounds, sheet and tin bars, etc.	8,977,450	362,630	48.3	717,393	225,277	1,074,436	48.6	2,129,905	649,507
Structural shapes (heavy)		4,873		357,484		9,405		1,047,552	
Steel piling				3,750				9,276	
Plates (sheared and universal)	15,990,020	1,235,756	91.2	1,204,368	40,019	3,557,742	89.5	3,457,871	123,645
Skelp				77,542	60,617			219,216	170,090
Rails—Standard (over 60 lb.)	3,625,000	205,472	66.9	211,223		596,214	66.1	592,975	
—All other	518,600	15,782	35.9	15,208		42,347	32.8	45,514	
Splice bars and tie plates	1,703,700	73,248	50.7	72,927		204,577	49.3	206,944	
Track spikes	373,200	13,116	41.5	14,359		36,176	39.0	37,562	
Hot Rolled Bars—Carbon		772,773		634,752	81,089	2,243,264		1,888,152	244,256
—Reinforcing—New billet		44,907		46,430		110,249		112,751	
—Rerolled		10,776		11,237		25,286		28,896	
—Alloy		285,542		207,598	41,174	838,416		610,737	110,640
TOTAL	21,207,210	1,113,998	62.0	900,017	122,263	3,217,215	61.0	2,640,536	354,896
Cold Finished Bars—Carbon		162,177		162,380		464,363		461,177	
—Alloy		34,864		32,927		109,967		97,774	
TOTAL	2,694,110	197,041	86.3	195,307		574,330	85.7	558,951	
Tool steel bars	214,970	13,135	72.1	12,211		37,542	70.2	35,319	
Pipes and Tubes—Butt weld	2,289,130	124,159	64.0	121,710		367,859	64.6	347,555	
—Lap weld	967,900	56,290	68.6	52,548		155,308	64.5	148,434	
—Electric weld	1,225,170	53,630	51.7	54,133		164,971	54.2	164,262	
—Seamless	2,659,250	212,120	94.1	205,482		604,365	91.4	589,932	
—Conduit	184,500	4,973	31.8	4,362		12,109	26.4	11,825	
—Mechanical tubing	1,004,450	74,176	87.1	76,446		214,513	85.9	219,475	
Wire rods	6,340,210	396,116	68.3	111,376	32,623	1,116,800	65.7	310,252	85,612
Wire—Drawn	5,468,830	318,040	68.6	181,132	4,802	906,243	66.6	505,491	12,540
—Nails and staples	1,224,880	62,169	59.9	61,087		183,747	60.3	179,103	
—Barbed and twisted	551,720	22,467	48.1	21,563		64,545	47.0	63,565	
—Woven wire fence	1,101,090	33,984	36.4	34,627		97,088	35.5	97,321	
—Bale ties	150,660	7,312	57.3	6,889		21,094	56.3	19,242	
Black Plate—Ordinary				39,512	95			103,948	561
—Chemically treated	464,000	14,765	37.6	14,055		44,368	38.5	42,253	
Tin and Terne Plate—Hot dipped	3,452,400	148,983	50.9	166,592		400,161	46.6	445,026	
—Electrolytic	1,780,450	53,980	35.8	56,545		138,624	31.3	129,507	
Sheets—Hot rolled	19,611,270	1,104,013	66.4	558,724	22,365	3,119,493	64.0	1,615,737	63,228
—Cold rolled	7,318,780	317,239	51.2	175,352		884,097	48.6	493,586	
—Galvanized	2,686,410	112,284	49.3	118,962		306,745	45.9	303,204	
Strip—Hot rolled	7,307,280	236,593	38.2	155,600	22,778	655,051	36.1	432,407	65,197
—Cold rolled	3,236,940	99,394	36.2	96,091		282,073	35.0	268,009	
Wheels (car, rolled steel)	348,800	27,209	92.1	26,118		75,107	86.6	74,686	
Axles	416,170	19,609	55.6	19,873		53,969	52.2	54,156	
All other	150,270	3,932	30.9	6,027		9,355	25.0	15,361	
TOTAL STEEL PRODUCTS				6,146,595	530,839			17,614,955	1,525,276
Effective steel finishing capacity	64,722,000								
Per cent of shipments to effective finishing capacity				102.4%				100.0%	



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It is sound because it will quickly and directly employ 3,000,000 people on a planned highway building program sorely needed before the war and absolutely necessary postwar.

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It is sound because it makes more efficient use of on-site employment and affords far more off-site employment in the production of materials and equipment. Thus, in addition to stimulating the consumer goods market, it induces far reaching employment throughout the production, transportation, and service industries. Studies made by the U. S. Public Roads Administration indicate that the proposed investment of 3 billion dollars annually in highways eventually results in business transactions totaling 9½ billion dollars.

Every American who wants to get early enjoyment of a better planned highway system, constructed better at the lowest bid cost, should write for and read the 64-page book entitled "A Sound Plan For Postwar Roads and Jobs." Among other things it points out that nearly enough in motor vehicle taxes is normally collected to pay for this sound, planned program if used for the purpose intended.

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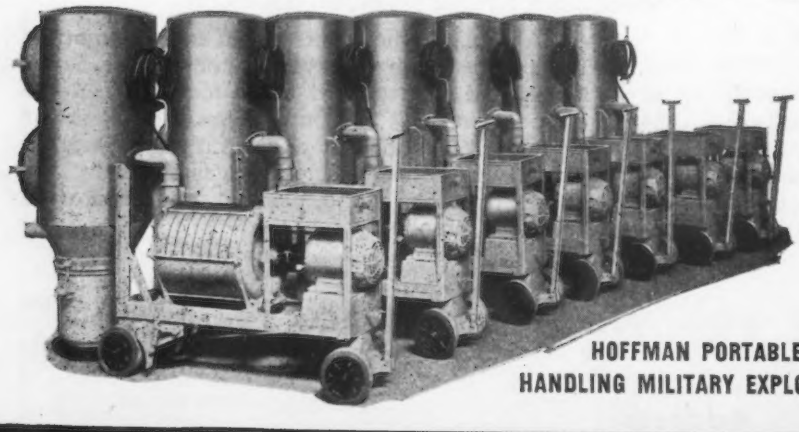

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• • • **An improved method** for heat treating armor plate has won for Carl G. Strandlund, vice president and general manager of the Chicago Vitreous Enamel Product Co., Cicero, the Chicago *Tribune's* "War Workers Award." In addition to the substantial time and cost savings, it is said to have greatly improved the quality of armor plate.

Presentation of the award, symbolized by a diamond studded gold Victory pin, was made April 26, by Maj. S. C. Massari of the Chicago Ordnance District.

Under the new method, the armor plate slabs are heated in the regular way, then quickly carried from the annealing furnaces, on transfer cars operating on rails, to a large press for quenching.

Strandlund designed special dies used in this press. They somewhat resemble huge "waffle irons." The "waffle iron," used for flat pieces, contains 7200 holes through which water is ejected. When the press locks a slab of armor plate against the die, a flow of water is ejected from the holes, which quickly quenches the

METAL CLEANING: *This shot blast room was installed at the Emeryville, Calif., plant of Westinghouse for cleaning rust and scale from transformers and marine battery cases prior to painting. The steel shot falls through perforations in the floor and is reclaimed.*

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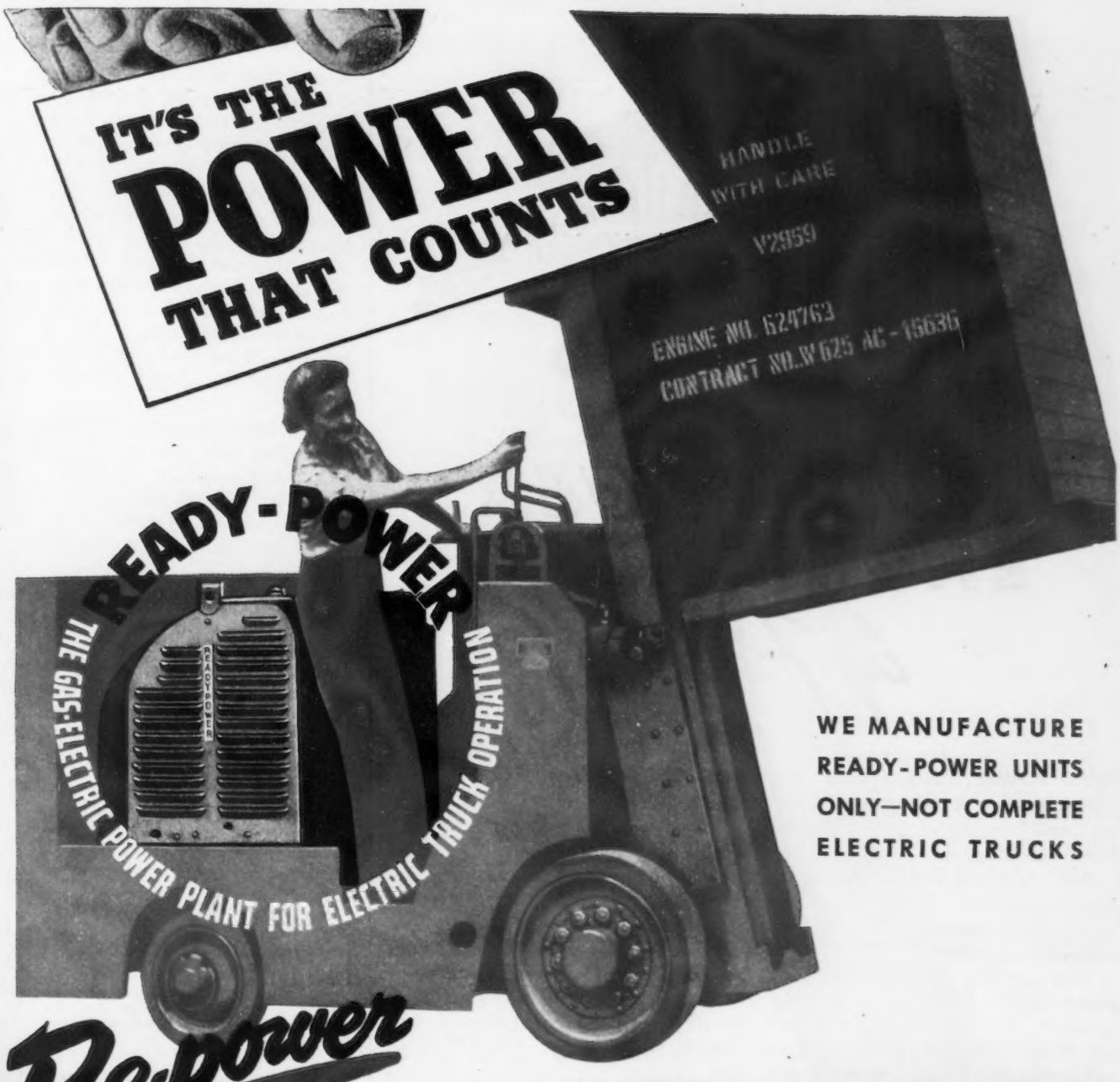

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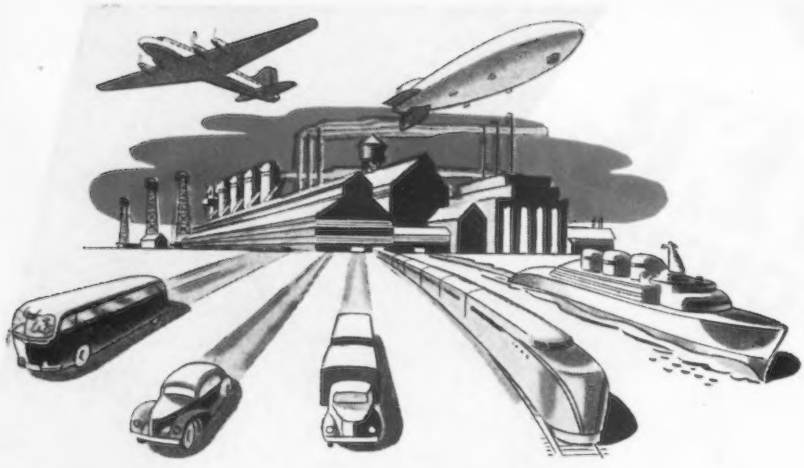

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TRANSMITTING FLUID POWER. Fluid Power is transmitted through tubes; it needs no shafts, gears, pulleys or belts.

When a system of tubes is used to transmit Fluid Power, it calls for wrinkle-free bends, leak-proof fittings, precise operating valves, flow without obstruction. It gets to be an engineering job.

FLUID POWER ENGINEERING. That's been Parker's business for twenty years—designing Fluid Power tubing systems, engineering them, building valves and fittings, and making fabricating tools. Often we do the fabricating, too.

Today, you'll find Parker-engineered Fluid Power systems in refrigerators and bombers, in chemical plants and locomotives—everywhere in industry.

LOOKING AHEAD. With at least one eye on the future, wouldn't you like to talk this through now with a Parker engineer? No matter what you make, or what kind of machines you operate, you are likely to find some interesting possibilities in the Fluid Power idea. An interesting booklet, giving you more facts about Fluid Power, will be sent on request. Address Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio.

PARKER
APPLIANCE COMPANY
CLEVELAND • LOS ANGELES
FLUID POWER ENGINEERING

plate. The 2500 tons of pressure exerted by the press against the slab prevents distortion, with the result that the slab emerges from the press flat.

Under the old method, it required about 15 man hours to complete the heat treating and subsequent straightening of armor plate slab. Under the Strandlund method, it takes only 6 or 7 min., because there is no straightening process necessary. One press using the Strandlund method does the work of about 25 cold straightening presses.

It is estimated that at the Cicero plant alone (the process has been put into use elsewhere), 1,000,000 man hours and 500,000 machine hours of work were saved in 1943. It is estimated that about 9c a lb. saving has been made.

The dies used in the press can be used to shape armor plate into various forms. This means that odd shaped parts can be fabricated exactly as wanted, making possible a variety of improvements to tanks. It is said that the Strandlund method has made possible radical improvements to some of the nation's most advanced types of fighter tanks.

Among the Week's Trade Notes

The Selas Co., Philadelphia, has changed its name to Selas Corp. of America. No change in organization, service or personnel has occurred.

•

Whitewater Machine Co., Whitewater, Wis., has changed its name to Whitewater Mfg. Co.

•

Allen-Bradley Co., Milwaukee, announces the removal of its New York offices to 155 East 44th St. Mr. C. N. Calkins remains in charge.

•

Allis-Chalmers Mfg. Co., Milwaukee, has added a new research and gas turbine development division. Dr. J. T. Rettaliata has been appointed manager of the division.

•

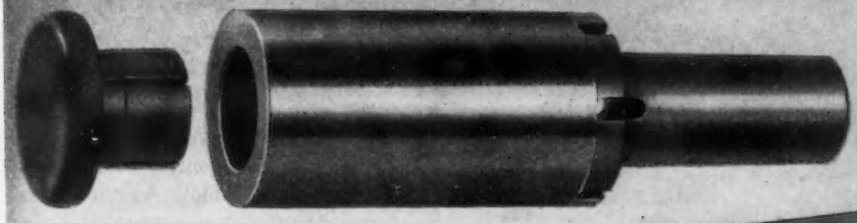
Tool Engineering Service of 505 North 22d St., Birmingham, Ala., Harry D. Frueauff, Jr., president, has been appointed representative for The Cleveland Automatic Machine Co. in the Southern states. Tool Engineering Service will handle sales and service on the full Cleveland line of automatic machines and Cleveland-Made High Pressure Hydraulic Die Casting Machines in Alabama, Georgia, Florida, Tennessee and the Carolinas.

•

Geo. M. Prescott Co. recently made an exclusive sales arrangement with Robbins & Myers, Inc. Springfield, Ohio, to handle R&M Hoist and Crane Division products in the Los Angeles district.

•

Gray Iron Founders' Society, national association of manufacturers of castings in gray irons, moved its Washington offices May 1 to 1201 19th St., N. W., from 1341 Connecticut Ave., N. W.



The Woodworth Guide-Guard cap of shock-proof material provides unusual protection of Carboloy bushing-type gaging members. Can be removed for gaging "blind" holes.

A NEW

Trouble-Free Carboloy Gage

BY WOODWORTH

NO LOOSENING
NO DISTORTION
NO STRESSES
NO STRAINS

Exclusive Segmented Shank

(Patent applied for)

Woodworth's exclusive segmented shank compensates for differences in coefficient of expansion between cemented carbides and steel . . . thus assuring a trouble-free bond between these two metals.

The segments permit "breathing" . . . and allow for expansion or contraction due to temperature changes, with no distortion to the Carboloy gaging member.

Write for Circular 44-C.

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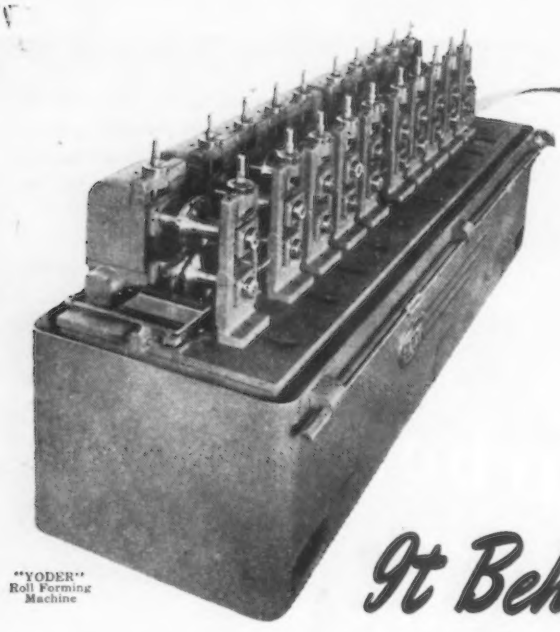
PRECISION GAGES • GROUND THREAD TAPS • FORM TOOLS • PRECISION MACHINED PARTS • HEAT TREATING • PLATING



"YODER" Roll Forming Machine

It Behaves In the Forming Rolls

Roebling Strip Steel, like all products of the Roebling Round, Flat and Specialty Wires Division, shows its quality at the point of final fabrication. Through the forming rolls, this quality steel demonstrates that specifications for steel analysis, dimensions, and finish can be met exactly by Roebling steel men.

Whether your operation calls for shaped wire, round wire for coiled springs, or flat wire for punching, drawing or forming, Roebling has the know-how, the men and equipment to produce wire that will make those operations trouble-free.

Forward complete description and specifications of your job for complete information and prompt action.

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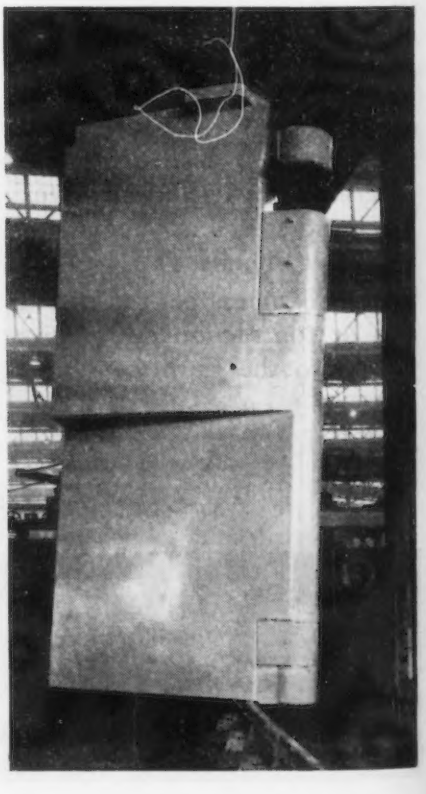
Bethlehem Shipyards Handle Heavy Repairs And Ship Conversions

• • • **Ship repair yards** of the Bethlehem Steel Co. completed 53 major conversions of widely varying types of vessels into Army and Navy fleet auxiliaries during 1943, the Shipbuilding Division of the company disclosed today. The conversion work was estimated at $100,000,000.

From 1940 through 1942, Bethlehem yards completed 142 major conversions. That type of activity, nevertheless, represented only a small portion of the total business at the 15 shipbuilding and repair yards of the company. Bethlehem already has reported that it constructed 380 ocean going fighting and cargo ships during 1943. In addition the Bethlehem yards repaired 7726 vessels during the same year. Conversion work was limited to the company's 10 repair yards, the five other yards confining activities to new construction.

Reflecting stepping up of the United Nations offensive against both Ger-

VICTORY SHIP RUDDER: *Here is the streamlined, unbalanced, contra-guide type rudder. Bethlehem has made around 4000 rudders of various types since March, 1941.*



The world's largest magnesium sheet and strip mill has recently gone into production.

Synthetic sapphires and rubies for the jeweled bearings of instruments and for spray nozzles, gages and spinnerets cost from three to six cents per carat while diamonds for this purpose cost about three dollars per carat. The making of these is an American war baby with a future.

NE alloys now make up as much as 20% of the tonnage of steel for aircraft.

A way has been found to put the "flags" (characteristic of natural bristles) on the ends of synthetic bristles for use in paint brushes.

The American chemical industry promises that it will employ more workers after the war than it did before.

Bituminous Coal Research, Inc., supported by the industry, has announced a $2,500,000 program, covering five years, with improvement in the use of soft coal as its object.

Dip-painted parts are being passed through an electrical field which removes the "tear-drop" in which the excess paint collects.

Electronic traffic control may replace the familiar signs and lights by signalling the driver through his dash radio.

The strongest natural fiber is Ramie, cultivated in Egypt 4,000 years ago. It is now being grown in this country and, if practical processing methods can be devised, it is expected to appear among our new textiles.

The new Orthicon camera has an "eye" composed of 400,000 pieces of light-sensitive silver which store voltage proportional to the light cast on them. It will be used in television and is said to be ten times as efficient as the iconoscope previously used.

Photo-electric cells check hand grenades at the rate of 4,000 per hour. When a defective unit appears on the conveyor, the mechanism rings a bell, lights a lamp, puts a dab of paint on the grenade, and makes a mark on a chart.

A new process for drying the paint on army tanks does the work in four minutes while the operator drives the tank through the "oven."

The use of the thyratron tube as a rectifier makes possible the use of an A. C. current supply to drive D. C. motors, the advantage being in very exact control of speed.

Extremes of temperatures encountered in flying have made necessary the development of new and better cements to replace the Canada balsam formerly used in the making of lenses.

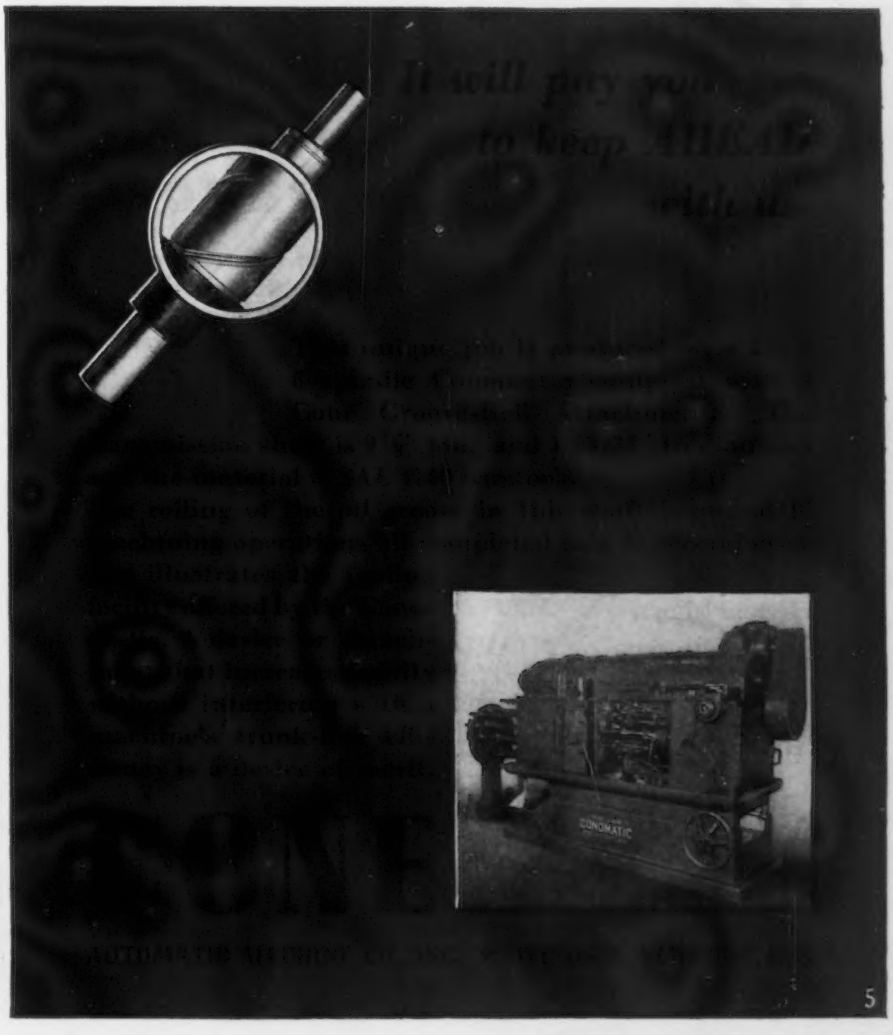
The cost of Diesel-produced electric power is expected to be cut in half as the result of war-time developments.

Street cars designed for post-war production will be lighter, quieter, better looking, and more economical in operation. They will have more comfortable seats and the windows will be higher to give strap hangers a better view.

A new fluorescent lamp, about the size of a marble, uses only two cents worth of current a year.

A new electronic method of sorting metals detects differences in material, alloys, heat treatment and thickness.

Success of the "bazooka" against enemy tanks has called public attention again to the rocket or reaction engine as a source of power. Such a motor has been constructed, for experimental use, that develops 260 horsepower for each pound of its weight. One horsepower per pound is the approximate output of the lightest internal combustion engines.



YOU HARDEN IT—WE'LL DRILL IT

"Hardsteel" Drills

SPEED THE DIES FOR THE WINGS OF TOMORROW

"HARDSTEEL" drills in thousands of plants are speeding die production—drilling hardened dies when last minute engineering changes call for holes in new locations or for additional holes—saving both critical materials and countless man-hours.

For fast, accurate drilling of steel hardened by any process to Rockwell "C" 40 or harder, there is only one answer—"HARDSTEEL," the three-cornered drill made from a special alloy material that can be reground quickly on any wheel.

"HARDSTEEL" is also available in reamers, tool bits and special tools. These tools are setting excellent production records on tough, hard-cutting steels and abrasive non-ferrous alloys.

Complete data on "HARDSTEEL" tools is contained in the "HARDSTEEL" Operator's Manual, together with instructions for using and many illustrations showing both parts recovery and production operations. Copy free on request.

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many and Japan, conversion of various vessels into troop transports represented the biggest single phase of the change-over program both from the standpoint of number and value.

Remodeling of sea-tested cargo ships into combat loaded troop transports for the United States Navy was the second largest group job in 1943. Third largest group comprised the making over of various vessels into naval repair ships.

The one time U. S. Fleet flagship, the 32,000 ton battleship Pennsylvania, was brought into the Bethlehem San Francisco ship yard for repair of extensive damage caused by the Jap attack on Pearl Harbor and for complete modernization. Although that was the first time in history a battleship had been placed in a commercial yard for a major overhaul and repairs, the yard completed the job in considerably less time than had been estimated. Another important assignment was the arming of four of the largest Matson liners soon after the Jap attack.

During 1942 Bethlehem yards also helped in the conversion of vessels into aircraft carriers. The Rio Hudson, a Maritime Commission C-3 vessel, about 75 per cent completed, was towed from an eastern construction yard to the Bethlehem Staten Island yard. Here she was converted into the aircraft carrier, the Avenger, which did yeoman work under the British flag in the invasion of Northwest Africa before she was sunk. The Navy oiler Chenango, previously the Esso Tanker New Orleans, also was made over into an aircraft carrier. The job involved removal of the superstructure and the bulkheads in the tank spaces, and the installation of necessary equipment, including two platform elevators.

Unusual jobs completed earlier involved the conversion of a C-3 vessel into the submarine tender Pelias and the making over of Admiral Byrd's famous Antarctic ship, Bear of Oakland, into a Coast Guard cutter.

Bethlehem yards also carried out major jobs on most of the large super liners now in operation. During a two-week lay up of the Queen Mary early in the war, a Bethlehem yard equipped that vessel with many guns. The ship returned later for additional major work, including installation of more guns.

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Why is that possible? Because Noblitt-Sparks has tremendous capacity for the production of metal tubing and stampings—plus the facilities and "know how" to fabricate them to your requirements. Yes . . . we make the tubing and form it into any shape—weld it to other parts stamped from metal—assemble, plate or paint the entire unit—ready to go into your product.

Some capacity available now—more later. So . . . write us what you have in mind for immediate or future production. For 25 years, Noblitt-Sparks engineering assistance and mass production facilities have been helpful to many of the largest manufacturers. Perhaps we can help you. Write us your needs and we will tell you what we can do. Just address . . .

Harlow Faulke

Vice-President and Director of Manufacturer's Parts Division
NOBLITT-SPARKS INDUSTRIES, INC. • COLUMBUS, INDIANA

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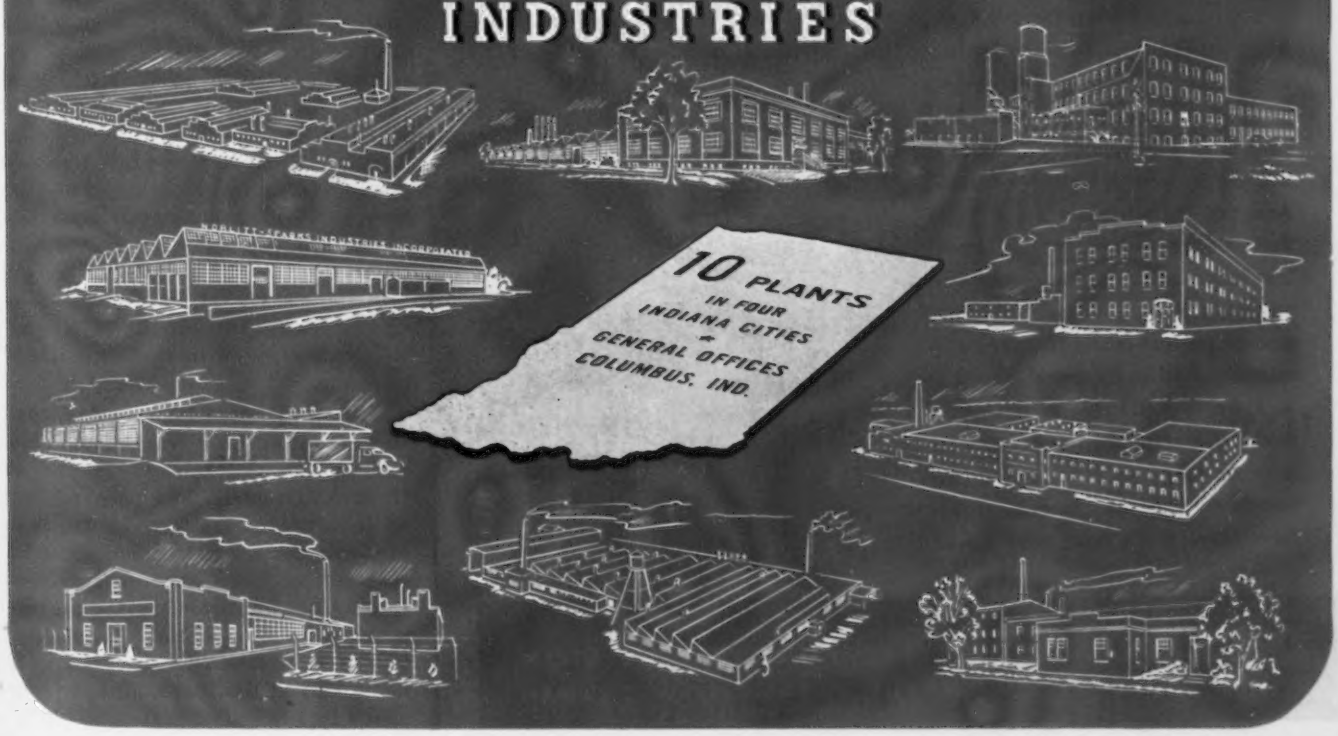
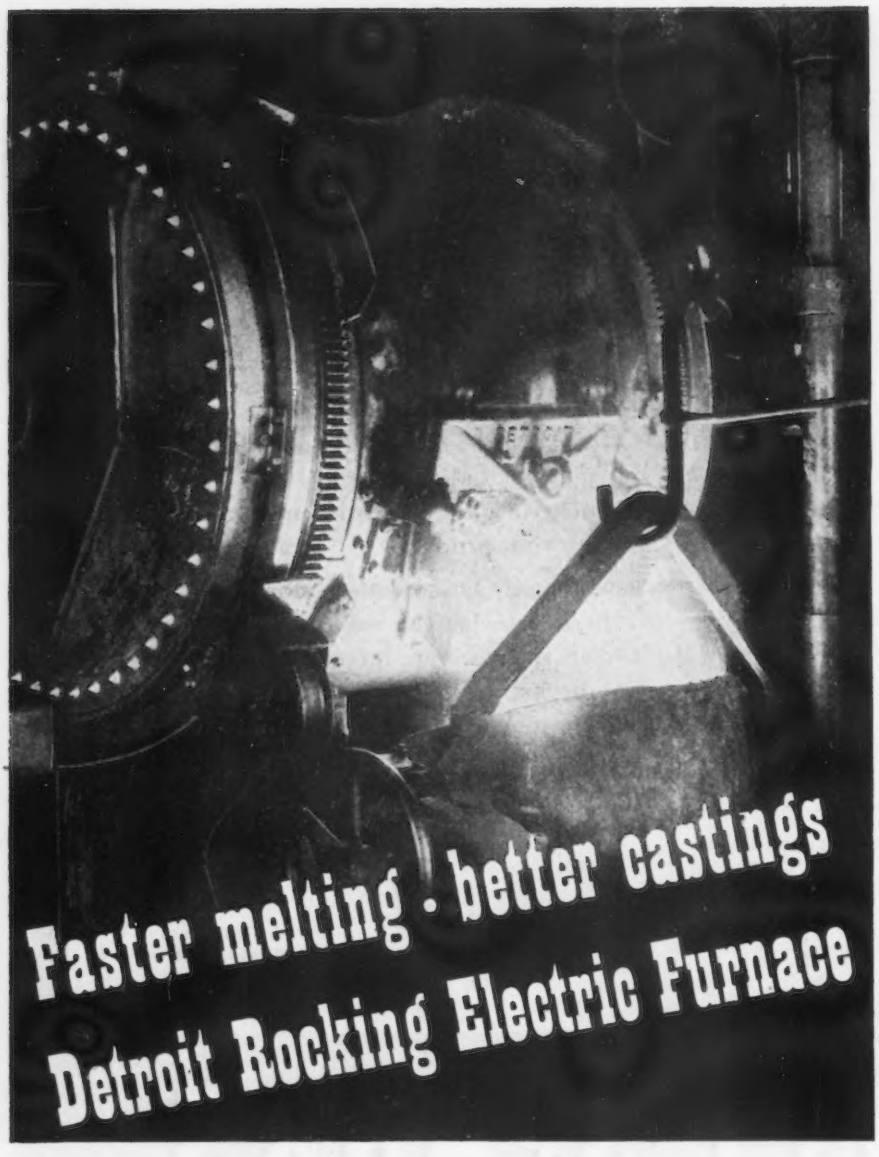
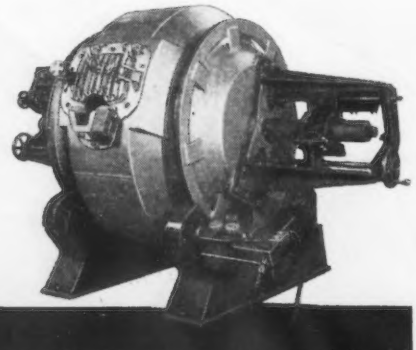




When that white hot metal leaps into the ladle from a Detroit Rocking Electric Furnace you can safely bet 50 to 1 you've got a perfect heat — for precise metallurgical control of every heat is comparatively easy with a Detroit Furnace. And you foundrymen know what that means: lower metal losses, less labor, more pounds produced per man hour, a higher percentage of perfect castings of uniform quality. And as to speed, here's a fact worth noting: with a Detroit Rocking Electric Furnace you can pour as many as 8 ferrous or 16 non-ferrous heats in one eight-hour day. Each heat may be of the same, or of a different analysis. Each heat will be poured with a minimum of dirt, fumes and hard work.

From many standpoints it will certainly pay you to operate Detroit Rocking Electric Furnaces in your foundry.



DETROIT ELECTRIC FURNACE DIVISION
KUHLMAN ELECTRIC COMPANY • BAY CITY, MICHIGAN

Maritime Awards 68 Tanker Contracts

Washington

• • • **To meet the** requirements of war operations, which are steadily widening in both scope and area, contracts have been awarded for the construction of 68 additional large ocean going tankers, and certain existing contracts have been rearranged so that these tankers may be delivered by July 1, 1945, the Maritime Commission announced.

To take advantage of the special abilities and facilities of the Sun Shipbuilding & Dry Dock Co., Chester, Pa., in the construction of large ocean going tankers, a contract for the construction of 24 T2-SE-A1-type tankers was awarded to that company, for delivery by July 1, 1945. This is a part of a total of 50 tankers scheduled for the Sun Shipbuilding & Dry Dock Co. during 1945. To allow for the full use of facilities in the construction of these tankers, a contract for the construction of 30 C4-vessels at Sun yard was withdrawn.

Contracts for the construction of 38 T2-SE-A1-type tankers has been awarded to the Kaiser Co., Inc., Swan Island Yard, Portland, Ore., and a contract for six of the same type has been awarded to Bethlehem-Sparrows Point Shipyard, Inc., Baltimore.

Contracts have been awarded to the Kaiser Co.'s, Vancouver Yard at Portland, Ore., for the construction of 20 of the 30 C4-type vessels removed from the schedule of Sun Shipbuilding & Dry Dock Co., and to the Kaiser Co.'s Richmond, Cal., Yard No. 3 for the remaining 10 C4-vessels. When the contract was let to Sun for the construction of C4-vessels, they were to carry tanks. They are now to be completed as troop transports and by transferring the contracts to yards where facilities will soon become vacant, it will be possible to have them completed in 1945, without interfering with the vital tanker program.

The award dated February 17, 1944, to the Kaiser Co.'s Vancouver Yard, calling for the construction of 60 C1-M-AV1-vessels, has been rescinded in order to make those facilities available for the C4 contract; and a contract has been awarded to Kaiser Cargo, Inc., at Richmond, for the construction of nine of these C1-M-AV1-vessels in addition to the 12 already under way at that yard, all to be completed by the end of March, 1945.

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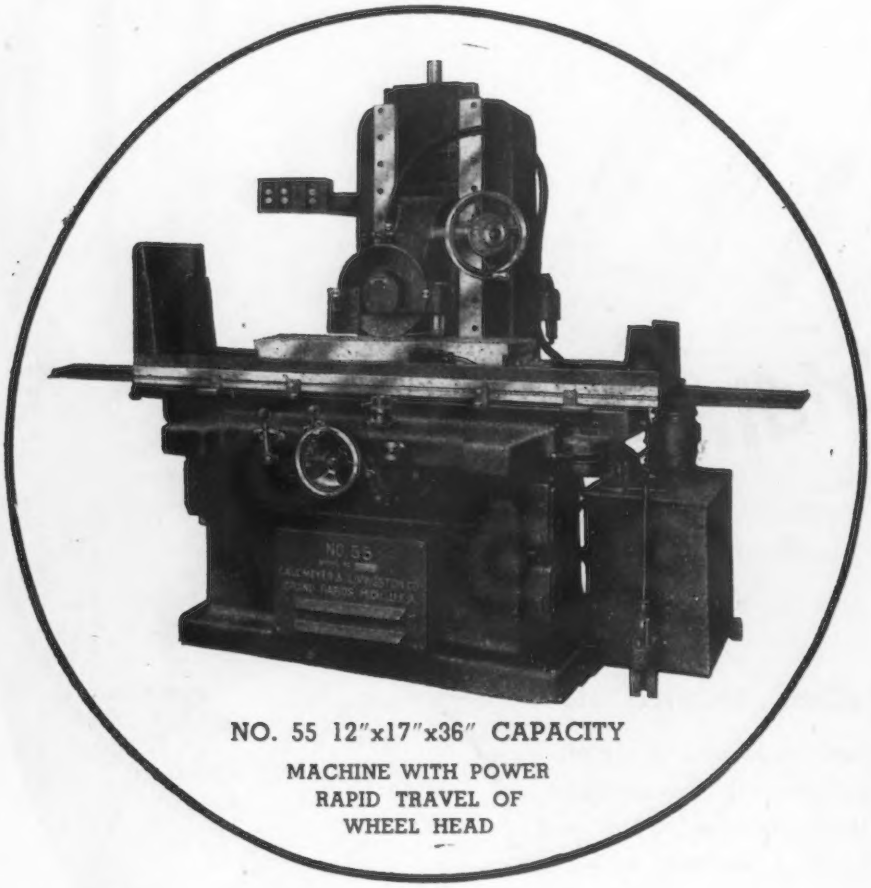

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MACHINE WITH POWER RAPID TRAVEL OF WHEEL HEAD

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Brazil Increases Industrial Output

• • • **Over the five year** period from 1938 through 1943, the value of Brazil's industrial output increased more than 50 per cent, Lester J. Kelly writes in *Brazilian Business*, publication of the American Chambers of Commerce in Brazil.

Brazil's industrial output rose to an estimated total of $1,565,000,000 in 1943 from $1,000,000,000 in 1938.

Rising prices partly accounted for the increase in dollar value of Brazilian industrial production during the war years. Nevertheless, Mr. Kelly reports, substantial expansion has taken place in many industrial lines, notably in construction industries, paper-making, rubber goods, chemicals, mineral processing and manufacture of miscellaneous consumer goods. The 1943 output, he notes, was more than three times the 1929 total.

The number of industrial workers has increased from around 1,000,000 in 1938 to an estimated 1,500,000 at the end of 1943, while the number of factories has increased from 36,902 to approximately 80,000.

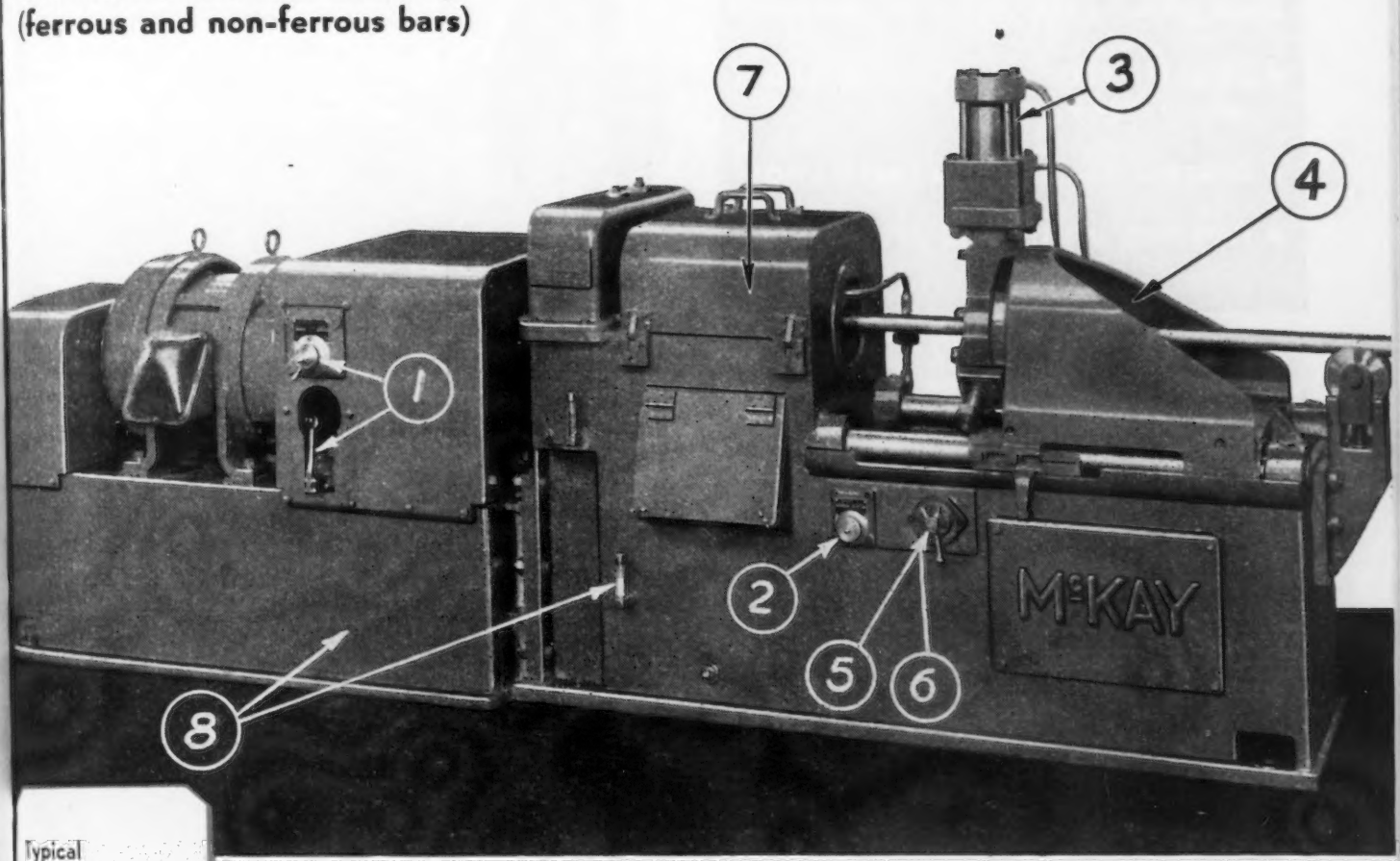
A summary of the growth of the metallurgical industries follows: Value of metallurgical production rose to approximately $85,000,000 from $57,400,000 in 1938. Among the newer metallurgical products are steel for spring manufacture, tool steel, barbed wire, strip steel for baling, many types of wire, a variety of forgings and enamelled products.

RE-ELECTED AGAIN: *Eric A. Johnston (left) was re-elected president of the Chamber of Commerce of the United States recently. Here he is shown with Rep. W. A. Colman prior to presenting his (Johnston's) 10-point plan as outlined in* THE IRON AGE, *May 11, page 119.*

Announcing the New McKAY
ROTARY HYDRAULIC BAR POINTER

COMPLETELY HYDRAULIC AND FULLY AUTOMATIC

A machine designed and engineered for the Cold Drawn Bar Industry (ferrous and non-ferrous bars)



Typical Rugged McKay Construction. Engineered for Performance, Precision and Safety

IMPORTANT FEATURES

1. Finger tip control of tool speeds (from minimum to maximum)
2. Precision variation of feed control
3. Hydraulically operated grips
4. Interlocked grip and feed (work is positively gripped before feed begins)
5. Pre-set length of carriage travel
6. Automatic rapid return of carriage
7. Cutting head fully enclosed in splash proof case
8. Hydraulic and coolant tanks integral with base. Sight gages indicate fluid level

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ENGINEERS AND MANUFACTURERS OF TUBE AND BAR DRAWBENCHES AND BAR SHEARS

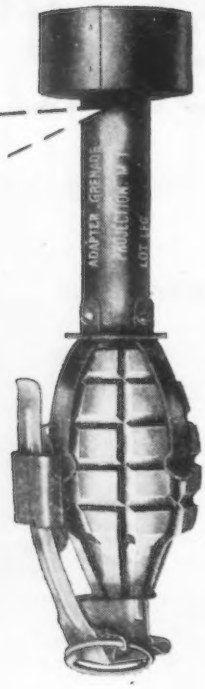
YOUNGSTOWN, OHIO

Wartime "package" of

"PACKAGED METAL ENGINEERING"*

that gives your postwar product

- LOWERED PRODUCTION, ASSEMBLING AND MATERIAL COSTS
- CONTROLLED PRECISION FABRICATION
- IMPROVED UTILITY AND APPEARANCE



THE GRENADE, fired from the end of a rifle with the aid of this Grammes produced Adapter, delivers a "package" of destruction and consternation to the enemy located a good distance away.

The Adapter, made up of a series of metal stampings, wire formings and tubing, ingeniously welded together and fastened with special drive screws, is a Grammes masterpiece of controlled precision fabrication, synchronized mass production processes, and cleverly devised methods of conveyor assembling.

Grammes Contract Manufacturing Service can be your *complete* manufacturing source, providing the all-inclusive services and facilities of "Packaged Metal Engineering"—**in one package . . . in one service . . . we take over ALL responsibility, acting as YOUR factory from Design Research to Drop Shipments.* Grammes specialized Metal Working Engineers with more than 69 years of metal fabrication "know-how" plus mass-production facilities can save you time, money, and materials on your product.

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Expansible Chamber Type Motors Shown In Seized Patents

• • • This is the 27th list of seized enemy patents, available on license from the Alien Property Custodian. These patents are grouped in classes. Sub-class numbers are shown first in parentheses, followed by the patent number, description of the patent, the inventor's name and nationality, and the date of issuance.

This series began in the Nov. 4 issue of THE IRON AGE, page 95, at which time procedures for obtaining the patents for use were described with information, concerning their usage and possibilities. Seized patent applications were shown in THE IRON AGE on July 8.

Class 121—Expansible Chamber Type Motors

(6) 1,689,731. Percussive pneumatic tools such as rock drills, riveting hammers, pick-hammers and the like, comprising a cylinder and a piston arranged to reciprocate therein. J. Kohlen, Germany. 10-30-28.

(7) 1,715,842. Hammer rock drill of the kind in which the hammer piston has a forwardly extending nose, a portion of which is fluted or of non-cylindrical section and engages the similarly shaped bore of the tool chuck for rotating the latter. E. Jones, South Africa, assignor, by Mesne Assignments, to Demag Aktiengesellschaft, of Duisburg, Germany.

(18) 1,678,985. Pneumatic rock drill with reciprocating valves. J. Kohlen, Germany. 7-31-28.

(19) 1,662,576. Valve for pneumatic tools wherein the valve is moved in one direction by the pressure of air compressed in front of the returning piston and is moved in the other direction by means of a spring bearing against one end face of the valve when the pressure upon the opposite end face of the valve is neutralized by the opening of a passage by the piston on the percussion stroke. H. Jeschke, Germany. 3-13-28.

(19) 1,854,656. Pneumatically actuated percussive tool of the kind in which separate floating valves, opened by the reduction of pressure in the cylinder when exhaust occurs on one or other side of the plunger, control respectively the working stroke and the return stroke of the plunger. J. Kohlen, Germany. 4-19-32.

(26) 1,678,734. Method of and means for operating the distributing valves of pressure fluid, more particularly pressure air operated tools having a reciprocating piston or striking member. W. Kohn, Germany. 7-31-28.

(26) 2,259,379. Pneumatic percussion tool with slide valve control gear. A. Herzbruch, Germany. 10-14-41.

(28) 1,995,230. Rock drill characterized by the fact that the spool drive loosely mounted on a valve guide axis is arranged in a cylinder which is in alinement with the central line of movement of a piston hammer. T. Suzuki, Japan. 3-19-35.

(31) 1,878,905. Rock drill of the fluid actuated type and in which such elements as a valve chest and the rotation rachet are incased by the cylinder. W. Smith, Sr., of Easton, Pennsylvania, Assignor to Ingersoll-Rand Company, of Jersey City, New Jersey, a corporation of Germany.

(33) 2,185,918. Precombustion chamber for Diesel engines having at least one partition member which divides the precombustion chamber into a plurality of spaces. F. Koch, Germany. 1-2-40.

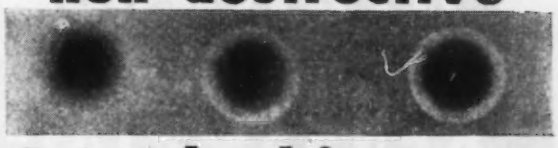
(36) 1,924,234. Spring cushion for the handle of pneumatic hammers and other tools. F. Faudi, Germany. 8-29-33.

(37) 2,090,342. Starting apparatus for internal combustion engines wherein the pressure produced in a cylinder by explosion of gases acts on a piston which rotates a driving member. A. Callsen, Germany. 8-17-37.

(38) 1,987,505. Pressure regulator of which the actuating parts are withdrawn from unauthorized actuation and are protected against the action of dust or the like. E. Edler, Germany. 1-8-35.

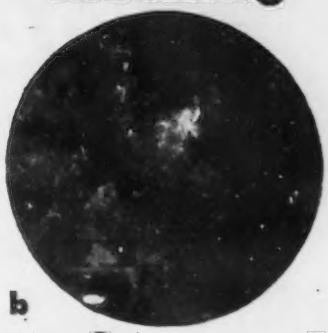
(38) 2,095,404. Servomotor employing a planetary gear piston connected to impart rotation through any angle, up to several

non-destructive



a

checking



b

and control

low voltage X-ray tool of many uses . . . in many fields

This newly designed Picker Series "50" Low Voltage X-Ray Unit is a tool of *many* uses in *many* fields . . . light metals, plastics, textiles, fibres, plywood . . . to name only a few. It provides accurate controls on spot welds, routinely and non-destructively, through periodic radiographic checks of operation procedures (as in example "A"). A typical example of its utility in the field of plastics is evident in the radiograph "B" above, where density variations would indicate the need for revisions in manufacturing technique.

Don't imagine that such X-Ray check-and-control operations require large space and cumbersome installations. On the contrary, this new Picker Series "50" X-Ray Unit, designed for just such work, is clean-lined, simple, compact and efficient . . . capable of all kinds of low voltage long wavelength radiography from 5 KVP to 50 KVP. There is definitely a place for this machine in your plant. Your local Picker representative will be glad to discuss with you its amazing utility and manifold applications. Or send for Picker Bulletin 1444 which gives complete details.

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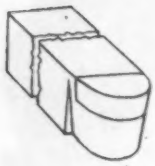

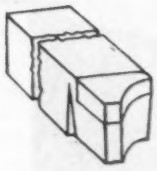

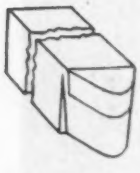

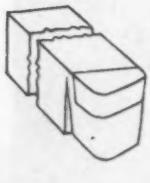

Fitting a carbide tool to the work is a job for specialists—and the skill with which the tool is ground is directly reflected in increased production. Kennametal standard tools will handle the majority of usual metal-cutting jobs, but even if their number were multiplied by ten, there still wouldn't be a sufficient variety. For the tool must be fitted to the work, not the work to the tool.

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revolutions, to a control shaft. C. Wurr, Germany. 10-12-37.

(38) **2,134,227.** Operating mechanism for chucks comprising a cylinder, a piston within the cylinder and means for actuating the piston by fluid pressure. H. Forkardt, Germany. 10-25-38.

(38) **2,142,628.** Control device for reciprocating working pistons. O. Ballert, Germany. 1-3-39.

(38) **2,160,565.** Fluid pressure cylinders for actuating brakes or other devices of the kind adapted to be operated by a reduction of the value of the pressure or vacuum. M. Savio, Italy. 5-30-39.

(38) **2,179,179.** Servomotor for the remote control of aircraft. E. Fischel and J. Thiry, Germany. 11-7-39.

(38) **2,219,967.** Hydraulic servomotor having a short-circuiting valve which may be quickly and positively opened and closed. J. Thiry, Germany. 10-29-40.

(38) **2,225,518.** Fluid pressure operated relay mechanism of the type in which a pressure differential is created by admitting fluid under pressure to one or the other of two conduits connected to operate a control device or motor, such as a cylinder having a control piston therein, a double acting valve, or the like. K. Blasig, Germany. 12-17-40.

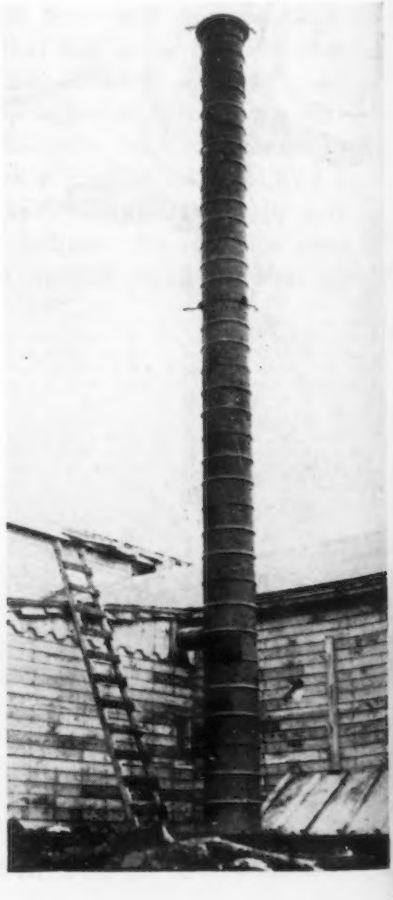
(38) **2,247,301.** Means for controlling a pressure fluid, which means are of the kind including one or more conduits for leading the stream of pressure fluid to a device to be operated thereby, e.g., a servomotor. O. Lesser, Germany. 6-24-41.

(38) **2,261,925.** Pressure fluid servomotor for high potential switches. A. Salzer, Germany. 11-4-41.

(38) **2,269,072.** Controlling device, such as a pressure relay for converting vibrations, for instance, electric oscillations, into pressure impulses. K. Wilde and G. Zink, Germany. 1-6-42.

(38) **2,308,214.** Fluid pressure operated mechanism for circuit breakers. H. Stegelitz

SEABEE SMOKESTACK: *Ingenious and thrifty, the Navy's construction-destruction experts welded 36 used oil drums together to make this smokestack for a boiler heating the dispensary at one of the American Aleutian bases. The makeshift stack is about 160-ft. high.*



PLUS 45 PIECES PER HOUR DRILLED AND TAPPED

● **AUTOMATIC**— Yes, because the cylinder blocks are transferred from station to station, and drilled and tapped without any attention from the operator.

● **PLUS**— because, in addition, feeding, locating, clamping and ejection of the work are accomplished automatically at the push of a button.

CROSS ENGINEERS designed and built this *special machine* to drill and tap five angular holes in a Diesel engine cylinder block. The results typify the principle behind every Cross *Special Machine*—high-speed, automatic removal of metal on equipment anyone can operate.

In this case, 45 blocks per hour are drilled and tapped at 80% efficiency, the work being moved from station to station and machined without any attention from the operator. But more than that, the work is fed, clamped, unclamped and ejected automatically, too. All motions are mechanically and hydraulically actuated, electrically synchronized and controlled. Inexperienced or unskilled operators maintain accurate tolerances and obtain large-volume production from a machine that occupies comparatively little floor space.

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and W. Schreiner, Germany. 1-12-43.

(40) 2,139,185. Pressure actuated piston lock release. E. Engel, Germany. 12-6-38.

(40) 2,204,279. Piston locking device by which pistons may be securely held in their cylinders against accidental movement at either or both ends of their stroke. L. Meyer, Germany. 6-11-40.

(41) 1,659,752. Multiple-controlled hydraulic servomotor consisting of an arrangement by which the servomotor may be controlled by a plurality of initial or primary control elements, such as relays, each of which is designed to respond at a given condition. H. Thoma, Germany. 2-21-28.

(41) 1,900,165. Power transmission mechanism comprising an actuating member and a member to be actuated thereby in conjunction with a source of auxiliary power; and which is particularly adapted for operating the brakes upon automobiles and other vehicles. G. de Monge, Belgium. 3-7-33.

(41) 1,902,356. System for transmitting movement of vehicles to control the brakes thereof. G. de Monge, Belgium. 3-21-33.

(41) 1,918,424. Fluid operated control device for automatically controlling and maintaining in a power system a desired magnitude of a condition, such as fluid pressure, temperature, volume at that desired value. W. Pontow, W. Abendroth and G. Schroeder, Germany, and K. Mayr, New York, N. Y. 7-18-33.

(41) 2,069,605. Control arrangement for motors, particularly rudder motors. E. Fischel, Germany. 2-2-37.

(41) 2,132,486. Control of fluid operated pistons. A. Lichte, Germany. 10-11-38.

(41) 2,172,315. Follow up type control device. K. Blasig, Germany. 9-5-39.

(41) 2,204,460. Motion transmission system comprising, in combination, a rotary pressure fluid motor, a jet pipe relay including a jet pipe mounted for full rotations about an axis coaxial with the motor and a reception orifice member mounted for full rotations with the motor. G. Wunsch, Germany. 6-11-40.

(41) 2,234,326. Control device for producing a yielding follow up action for servomotors. H. Tiebel, Germany. 3-11-41.

(41) 2,244,296. Piston servomotor of the type which serves to strengthen the adjusting forces produced by a governor, and in which the inflow of the working fluid which moves the piston to and fro, to one or other of the work chambers of the piston is controlled by pairs of control edges in dependence on the movements of an adjusted member actuated by the governor and the piston. H. Heinrich and M. Hurst, Germany. 6-3-41.

(41) 2,251,729. Control device comprising, in combination, a single acting servomotor; a source of pressure fluid; and a relay connected to control in response to an outward impulse a flow of pressure fluid for operating said servomotor. G. Bach, Germany. 8-5-41.

(41) 2,262,173. Automatic regulating apparatus for regulating a predetermined operating condition of a second apparatus. F. Fischer, Germany. 11-11-41.

(41) 2,278,396. Means for controlling by a regulated yielding or elastic follow-up system the operation of servomotors or similar relay apparatus, for example, such relays as operate rudders, valves, and the like. K. Saur, Germany. 3-31-42.

(44) 1,832,337. Device for operating bulkhead doors of vessels from a central station and from their specific location by the pressure of a liquid. D. Wiese, Germany. 11-17-31.

(45) 1,842,725. Driving mechanism for machine tools, such as planing machines, grinding machines, and the like. W. Link, Germany. 1-26-32.

(45) 1,917,116. Fluid distributor device for fluid driving gears. K. Hentschke and O. von Bovert, Germany. 7-4-33.

(45) 2,182,908. Hydraulic control system for machine tools. F. Wegerdt, Germany. 12-12-39.

(46) 2,204,365. Lifting platform for hydraulic and pneumatic operations which serves particularly for raising vehicles. K. Klemm, Germany. 6-11-40.

(57) 1,943,637. High pressure rotary engine, especially for hydraulic transmissions. E. Sturm, Germany. 1-16-34.

(68) 1,762,983. Engine, pump, compressor, and the like of the kind referred to in which a stationary member acting as an engine cylinder is surrounded by a cylindrical hollow member acting as a piston. H. Heinrich, Germany. 6-10-30.

(76) 1,854,670. Rotary engine of the type in which the reciprocating piston of the usual crank mechanism is replaced by a piston or a set of pistons in the shape of a radial vane or a set of vanes which rotate bodily about the axis of the machine. O. Ridder, Germany. 4-19-32.

(84) 1,664,987. Rotary engine comprising a cylinder provided with a central portion hav-

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WELDING STAINLESS CLAD

Arcos has a bulletin describing this Stainless Clad job... the grade of electrodes used, the technique of welding, and the welding procedure involved. This bulletin will be mailed you upon request or ask your Arcos Distributor for it.

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Cleveland, Ohio.....Williams & Co., Inc.
Columbus, Ohio.....Williams & Co., Inc.
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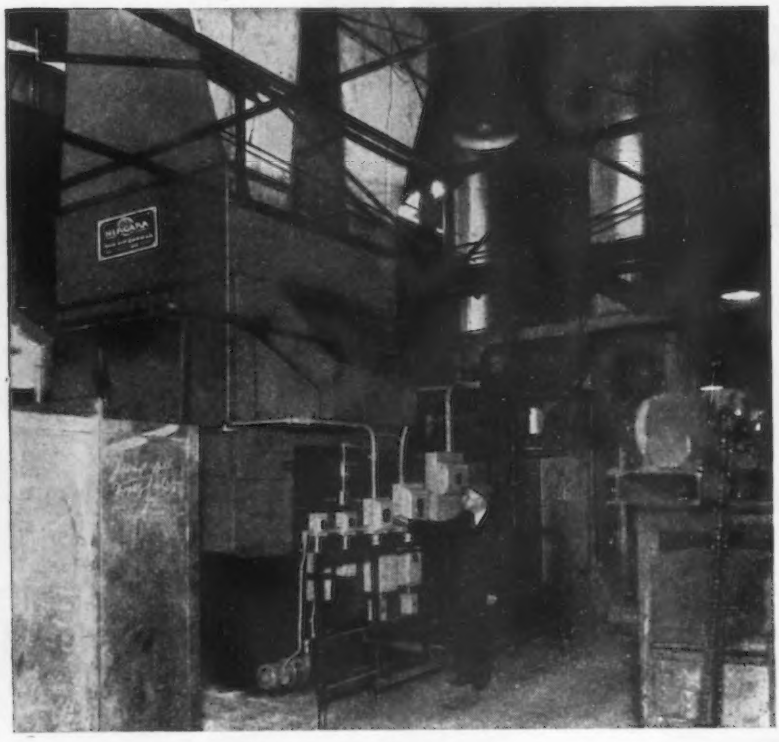

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ing annular recesses adjacent to its ends and having ports for the intake and exhaust of motive fluid. R. Meyer, Germany. 4-3-28.

(84) 1,726,462. Compressed air engine of the type comprising radial blades or vanes adapted to rotate within a substantially crescent shaped working chamber. K. Wittig, Germany. 8-27-29.

(84) 1,865,666. Rotary engine comprising a stator chamber and a rotor rotatably mounted therein, a rotor piston slidably mounted within and diametrally of said rotor, piston consisting of a rigid structure comprising a central body and two hub-like members fixed thereon. G. Aruga, Italy. 7-5-32.

(102) 2,134,466. Compound steam engine of the Woolf type with valve gear. H. Lentz and H. J. Lentz, Austria. 10-25-38.

(102) 2,173,541. Compound engine of the reciprocating piston type. W. Rieger and O. Hartmann, Germany. 9-19-39.

(108) 1,690,126. Fluid controlled system for double-acting reciprocating piston compound engines. W. Nielebock, Germany. 11-6-28.

(108) 1,748,390. Intermittent gear consisting of a plurality of spacedly disposed subsidiary gear wheels, a large master gear wheel and a set of gear teeth on the master gear wheel arranged in the same plane to produce a partial revolution of the subsidiary gear wheels. F. Otto, Germany. 2-25-30.

(108) 1,748,445. Steam controlling device for alternately working and direct acting compound steam engines. J. Fahdt, Germany. 2-25-30.

(108) 1,979,161. Control mechanism for double cylinder steam engines having slide valves without connecting rods, as required particularly for the actuation of boiler feed pumps. W. Klein and G. Moering, Germany. 10-30-34.

(111) 1,977,924. Eccentric reversing device for multiple cylinder engines. A. Sunder, Germany. 10-23-34.

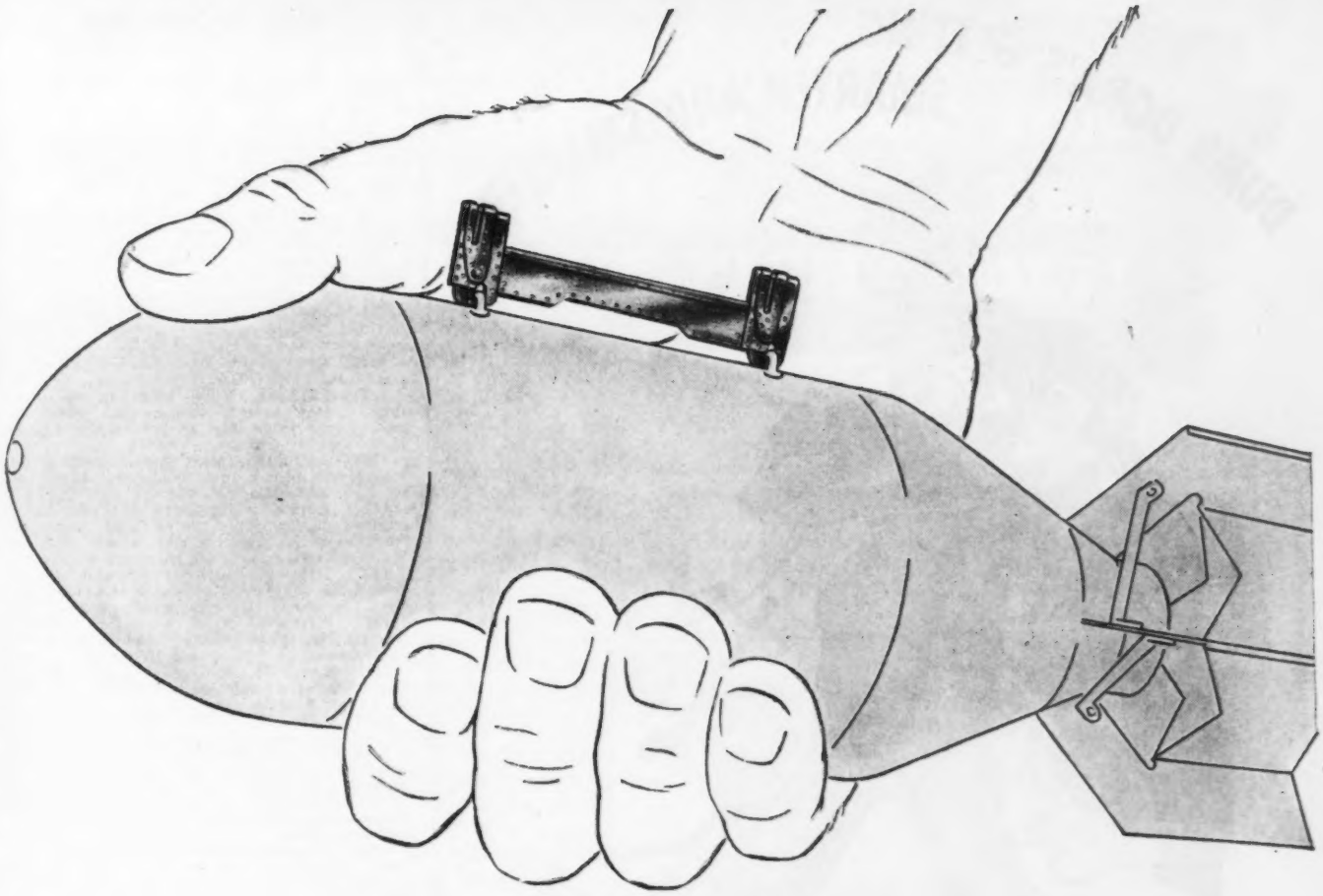
(113) 1,746,104. Steam-distribution system for Woolf's piston compound engines. R. Christiansen, Germany. 2-4-30.

(119) 1,661,582. Piston engine of the type in which the cylinders are lying in such a position in relation to the driving shaft that the latter cannot be operated by means of the usual piston rod and crank connection. J. Szydlowski, Germany. 3-6-28.

(122) 1,804,921. Rotary valve gear, especially for multi-cylinder engines and the like in which the pressure of the driving fluid is

---

BOMBS FOR MITCHELLS: *This bomb trailer, leaving an ammunition building at a bomber base in England, is headed for the R.A.F. Mitchell bomber base that spearheaded the attack on Northern France on April 19. The bombs, on their carriages, are shunted off by the armorers as the trailer arrives at each aircraft.*



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Excess weight is a severe handicap on a bomber. Strength combined with extreme light weight is necessary in the device which holds the bombs in place and releases them on split second, electric control—as fast as 1/50th of a second.

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Careful design and precise manufacture go into these bomb shackles and bomb racks and Pollak turns them out by the thousands for the Army and the Navy. How well Pollak has done its job for the last two and a half years is indicated by the awards to Pollak of the Army-Navy "E" with four stars.

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The original Army-Navy "E" award to this company has been renewed four times. Each of the four stars on this flag symbolizes six months of exacting service to our Armed Forces.

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SPEEDI-DRI is the finest product of its kind for removing oil and grease from floors; setting up a non-skid surface, and retarding fire. But 101 new uses for SPEEDI-DRI have been discovered! SPEEDI-DRI reclaims oil-soaked rope and power belts; reconditions oil-soaked shoes and clothing; deodorizes the plant; removes oil film from tools; is used during tumbling and after heat-treating processed parts to remove oil-film; increases light reflection in dark plants; helps prevent dermatitis caused by oil-soaked shoes; dries up floors that "bleed" in hot weather; better than sand in fire buckets. You'll discover many other uses for it, too. It's indispensable! Write at once for literature and FREE SAMPLE.

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SPEEDI-DRI
OIL AND GREASE ABSORBENT

utilized for packing the slide valve body with regard to its seat. F. Ellyson, Germany. 5-12-31.

(127) 1,954,417. Valve gear for steam engines in which the valve spindles are parallel to the axis of the cylinder and project with their ends into a space transversed by the cam shaft. H. Lentz, Austria. 4-10-34.

(127) 1,964,226. Control of consecutively arranged inlet and exhaust valves in piston steam engines. A. Sunder, Germany. 6-26-34.

(127) 1,969,417. Distributing valve gear for steam engines. H. Lentz, Germany. 8-7-34.

(127) 1,976,325. Poppet valve gear for reversible piston operated elastic fluid engines having two inlet valves and corresponding exhaust valves. A. Caprotti, Italy. 10-9-34.

(127) 2,081,458. Cam actuated poppet valve gear. H. Lentz, Germany. 5-25-37.

(127) 2,113,149. Valve gear for reciprocating engines having poppet-type valves arranged in a valve chest in axially alined pairs. H. Wiegand, Germany. 4-5-38.

(127) 2,136,013. Insert for converting piston-valve engines into poppet-valve engines. H. Lentz, Austria. 11-8-38.

(127) 2,149,353. Reversing gear for steam engines with poppet valve gear, especially for locomotive and marine steam engines. H. Lentz, Germany. 3-7-39.

(127) 2,165,755. Idle-running and starting device for poppet valve geared steam locomotives. H. Lentz, Germany. 7-11-39.

(127) 2,172,562. Valve gear for reversible reciprocating fluid pressure engines, especially for locomotives. H. Lentz, Austria. 9-12-39.

(127) 2,182,925. Rolling lever valve motion for locomotive and marine steam engines. H. Lentz, Austria. 12-12-39.

(127) 2,190,586. Valve control mechanism for internal combustion or for steam engines in which the movement of the valves is cushioned by means of a positively controlled oil cushion. W. Rieger, Germany. 2-13-40.

(127) 2,201,907. Valve gear for reversible reciprocating fluid pressure engines, especially for locomotives. H. Lentz, Austria. 5-21-40.

(133) 1,675,320. Piston valve for steam engines, principally designed to be used in connection with locomotives, having two different and distinct sets of steam passages in each piston head for the purpose of allowing the admission of steam from the steam inlet chamber into the steam cylinder. E. Allzeit, Germany. 7-3-28.

(133) 1,869,463. Poppet valve for steam distributing gears. A. Caprotti, Italy. 8-2-32.

(136) 1,616,667. Auxiliary exhaust valve for uniflow steam engines. F. Peltzer, Germany. 2-8-27.

(143) 1,745,266. Throttling governor for rotary engines with sickle-shaped working chambers. R. Meyer, Germany. 1-28-30.

(150) 1,749,695. Controlling device for machines such as prime movers, steam pumps and the like, having reciprocating pistons, the said device being particularly intended for use with such machines which are made without flywheels. R. Drath, Germany. 3-4-30.

(152) 1,723,449. Slide valve gear for reciprocating steam engines. F. Tolkien, Germany. 8-6-29.

(152) 1,986,084. Controlling means for double-acting reciprocating engines without flywheel. F. Tolkien, Germany. 1-1-35.

(157) 1,965,914. Motor with fluid actuated valve. F. Tolkien, Germany. 7-10-34.

(157) 1,986,083. Steam engine with fluid operated valves, in which at each end of the valve a differential piston, that is to say, a small and a large piston, is provided. F. Tolkien, Germany. 1-1-35.

(166) 2,119,904. Variable valve lift for oscillating valve gears. A. Caprotti, Italy. 6-7-38.

(167) 1,625,632. Valve gear for steam engine and method of operating same. J. Stumpf, Germany. 4-19-27.

(167) 1,642,538. Valve gear capable of use not only with compressed air and steam engines, but with gas engines as well. M. Buchler, Hungary. 9-13-27.

(167) 2,235,223. Valve distribution for piston steam engines, especially locomotive steam engines and the like with revolving reversing shafts. H. Lentz, Germany. 3-18-41.

(169) 1,965,977. Spark plug with a composite central electrode for internal combustion engines. H. Kohl and P. Scholz, Germany. 7-10-34.

(178) 2,186,497. Valve control mechanism for changing the setting of the valves to cause a reversal of an engine, such as a steam engine, without using the large and numerous parts heretofore used in valve control mechanism. W. Rieger, Germany. 1-9-40.

(186) 1,777,122. Process of working on beryllium sublimates containing sulphur and aluminum with a view to obtaining beryllium compounds. H. Lowenstein, Germany. 9-30-30.

...THIS NEW KIND OF BOLT FOR WOOD ASSEMBLIES . . . . . THE LAMSON *WEATHER-TIGHT* BOLT!

U. S. Patent No. 2056688

● Micah Rugg started a country blacksmith shop in Marion, Southington Township, Conn., in 1818 and made scythes, steel bear traps *and bolts.* By 1839 Mr. Rugg had personally sold nearly 3000 Carriage Bolts at an average price of 16c each. In 1840, he teamed up with Martin Barnes, and the company of Rugg & Barnes became the first bolt manufacturer in America. First type of bolts made were Carriage Bolts, made from square bar wrought iron stock brought over from England. Threaded portion was hand-swaged to roundness, *shank beneath the head left square!*

Since 1837, Henry A. Miller of Miller's Station, Conn., had been making wood and metal clock dials. In 1853 he considered this new enterprise of making bolts, and thereupon admitted two nephews to his business, Thomas Henry Lamson and Isaac Porter Lamson, and a third young man named Samuel Washburn Sessions. They produced fire shovels, fire tongs, cranes, andirons and—*bolts and nuts.* They operated with varied success until the panic of 1857. Surviving the war between the States, in 1867 a partnership of Lamson & Sessions was formed at Mt. Carmel, Conn., and in 1869 it was moved to Cleveland, Ohio, to be closer to the source of raw materials and markets.

At top, left, are two of Lamson & Sessions' first Carriage Bolts removed from wood piling on the sea-coast some years ago. You can see the square shank under the head. At center, left, are two modern heat-treated Lamson & Sessions' Carriage Bolts—with the same square shank beneath the head. And at the bottom, left, are what we think is the successor to Carriage Bolts for many applications—the Lamson *Weather-tight* Bolt for wood assemblies.

In place of the square shank beneath the head of the old style Carriage Bolt is a tapered, splined shank—presenting *six times* as much gripping surface to the wood as the Carriage Bolt shank.

The top of the *Weather-tight* Bolt has a convex shape, and on the under side of the head are two concentric, V-shaped rings which compress wood fibers when the bolt is pulled down tight. So strong is this head that stock bolts have been pulled, head and all, undamaged, through a 3-inch yellow pine block—a test you can make yourself.

No counterboring is necessary to make a smooth assembly with Lamson *Weather-tight* Bolts—for they draw down flush with the wood surface. Tapered splined shanks prevent their turning when the nut is applied. They fit a bored hole like a cork in a bottle—moisture cannot enter from either end! Lamson *Weather-tight* Bolts are made from 3/16" to 3/4" in diameter, and in any length. If you have wood assemblies to make—send for further details and prices. Samples for your tests on request.

THE LAMSON & SESSIONS COMPANY, General Offices, Cleveland, O.

"BOLTS, NUTS & SCREWS"—1944 REVISION, Cloth bound, Limited edition, 180 pages of technical, practical information. Sent prepaid for *$1.00—cash or check must accompany your order.*

"BOLTS ARE IMPORTANT!"—24-page booklet of currently useful information for buyers of headed and threaded products, and describing Lamson & Sessions' specialty fastenings which have wide industrial applications *—now, and in the post-war period. Sent gratis.*

"THE LAMSON BLUE BOOK"—is our standard Catalog of standard products excepting our Aircraft products. *Sent gratis.*

"SIMPLIFIED STOCK LIST"—Of bolts, nuts and screws, conforming to latest revisions of the Office of Price Administration, and of great value in showing you in what ratio quantities of various standard products are kept in stock for deliveries, by your jobbers and in our own (and other bolt manufacturers') warehouse stocks. *Sent gratis.*

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Please send us ☐ Lamson Blue Book ☐ Bolts, Nuts & Screws ($1.00)
☐ Bolts are Important! ☐ Simplified Stock Sizes

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Employed by (Name of Company) _____

Street Address _____

City and State _____

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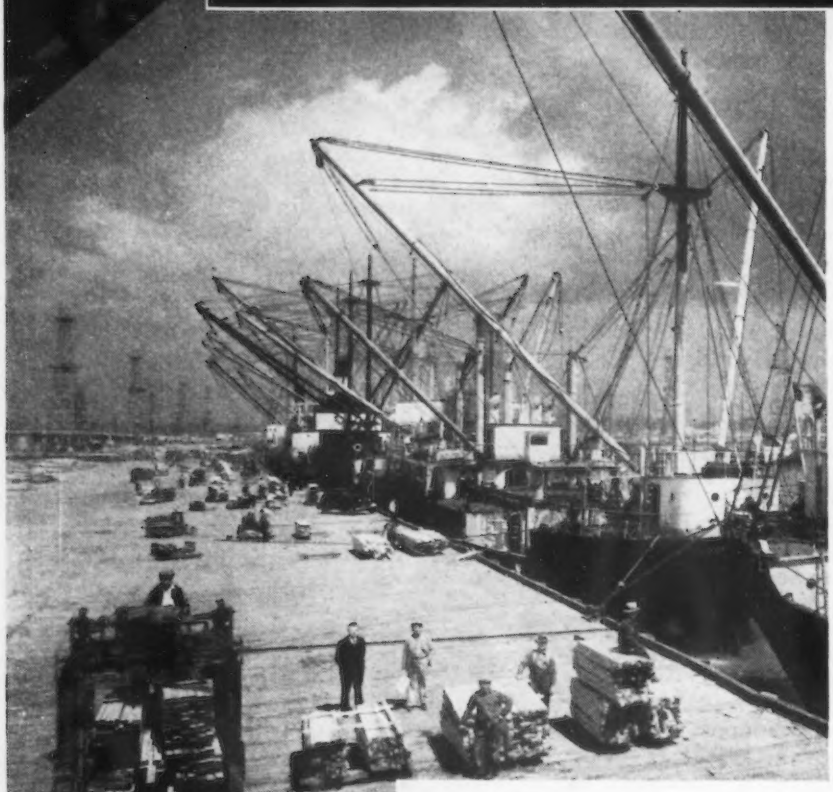
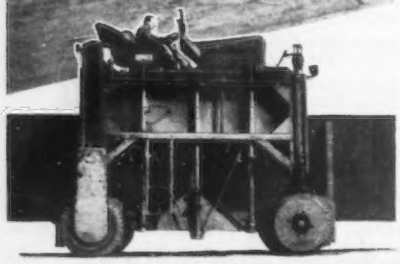
Your Jobber Stocks the Lamson Line

The ROSS CARRIER —An Economy-Link in Marine Shipping





Warehouse, yard, dock — all are economically linked by the Ross Carrier and its unit-load handling system. Wherever materials and cargoes can be transported in units or "packages" — Ross Carriers and Lift Trucks can handle them faster and at minimum cost . . . Keep materials moving. Write for Bulletin I-54.

The ROSS CARRIER COMPANY, Benton Harbor, Michigan

Branches: San Francisco - Seattle - Portland - Vancouver, B.C. - Pine Bluff, Ark. - New York City - Hoboken, N.J.

ROSS

HEAVY DUTY MATERIALS-HANDLING EQUIPMENT

BENTON HARBOR • MICHIGAN

GM Plans Veteran Rehabilitation Program

Detroit

• • • **A flexible** program aimed at providing specialized training and educational "rehabilitation" for returning war veterans formerly employed by General Motors has been inaugurated at the General Motors Institute of Technology in Flint. Veterans will be enrolled in the special course upon recommendation of the General Motors division where they are employed. The men will alternate their training between classes and practical work in their respective plants or divisions every four or eight weeks.

The new course is supplementary to the regular four-year cooperative engineering program at GMI. The mechanical courses to be offered returned war veterans will take into consideration the fact that education and training processes of many capable young men have been interrupted at various stages by war service.

Added maturity will have to be considered, it was explained. Many men will have desires and hopes to take up their training where they left off; others will have forgotten many things and will have difficulty in going on from where they were; still others may need exploration training to get them oriented into employment.

It is assumed that from all of these groups there will be those who have special abilities and will be looking forward after proper training to opportunities for advancement.

800,000 Affected by New Manpower Rules in Detroit

Detroit

• • • **About 800,000** employees of about 1000 firms were put under manpower ceiling regulations adopted late last week by the Detroit area War Manpower Commission. The regulations, which had been opposed as unnecessary by labor and management and labor groups, follow similar rules in other areas, but affect small tool, die, pattern and machine shops with as few as eight employees. The government action was taken over the management and labor protests on the grounds that forthcoming manpower needs will require tighter controls.

The employment ceilings of May 1 provide the base for functioning of the plan. Employers having 50 or more people on payrolls on that date, must reduce to 95 per cent of their totals by July 1 or Aug. 1.

FROM METAL CLEANING TO ASSEMBLY
Sooner
The Bullard-Dunn Station Type Conveyor
• Lifts heavy weights to convenient heights (3000 lbs. up to 40 inches for the smaller size; 9000 lbs. up to 66 inches for the larger size).
• Is built by Bullard, to Bullard's machine tool standards.

WITH THIS BULLARD-DUNN AUTOMATIC STATION TYPE CONVEYOR

This machine is conveying heat treated tractor parts through the Bullard-Dunn Descaling Process, but it is equally valuable for other sequences too;—for example, plating, blackening, pickling, bonderizing, cleaning aluminum prior to welding, and heat treating.

This machine expedites production like other conveyors, but as a machine it is different. It is built like a machine tool by a machine tool company. It is rugged and can carry heavy, unbalanced loads through high lifts. The Geneva type of index motion produces smooth indexing. The machine is compact, the oil for the hydraulic operation being within the column itself, and the pump and motors being mounted on the column. The simplicity of the machine and few parts involved make for uninterrupted service.

Write for the booklet giving specifications and other information.

BULLARD-DUNN DIVISION OF THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT

BULLARD-DUNN Conveyor

Look Into Everything ROLLER CONVEYORS Can Do . . . Ask STANDARD CONVEYOR

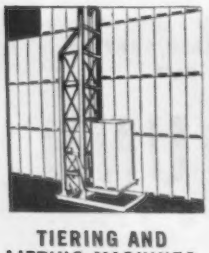
THE steps you take now — the investment in equipment that you may make to cut handling costs will not only pay dividends immediately but can be expected to yield equal or even greater returns in postwar days to come, when handling and other unproductive costs will be under the closest scrutiny.

For example, roller conveyors installed now will be useful in many ways no matter what you may be making or handling when peacetime is here. Roller conveyors are unequalled in low first cost, flexibility and minimum operating expense. They handle a wide range of commodities —parts, packages, units, cartons, cans, bottles, barrels, bundles, drums, boxes. They are available in light, average, or heavy-duty types for either portable or stationary use — in a wide variety of sizes, styles and lengths. Roller conveyors are built in their entirety by Standard, including the vital bearings which are manufactured to the highest standards.

Besides roller, Standard builds belt, chain, slat, and push-bar conveyors, also spiral chutes, tiering and lifting machines, portable pilers, and pneumatic tube systems.

On any conveyor requirement Standard Conveyor is equipped by experience and facilities to recommend and furnish the right type of equipment.

STANDARD CONVEYOR CO.
General Offices: North St. Paul, Minn.
Sales and Service in Principal Cities


TIERING AND LIFTING MACHINES

PORTABLE PILERS

SPIRAL CHUTES

PNEUMATIC TUBE SYSTEMS

Government Trains 12 Million in Four Years

• • • **Enrollments** in federal, state and local training programs authorized by Congress as a means of providing civilian war production workers with necessary skills have totaled more than 12,000,000 in less than four years and have advanced to a remarkable degree the home-front "battle of production," Paul V. McNutt, head of the two federal agencies chiefly responsible for training the nation's wartime labor supply, announced May 10.

Mr. McNutt's announcement was made in his dual capacity as chairman of the War Manpower Commission and administrator of the Federal Security Agency and was based upon reports received by him from the U. S. Office of Education, which administers vocational and college training, and the WMC Bureau of Training, which coordinates all training activities including Apprentice Training Service and Training Within Industry of the WMC. The training totals are cumulative from July 1, 1940.

The heaviest training loads were carried by trade and vocational

---

STRONGER TRUCKS: *With 1944 commercial truck production underway, Dodge Division of Chrysler Corp., announced that heavier transmissions, universal joints, and propeller shaft, and other similar improvements have been made. The heavier main shaft of the 1944 Dodge truck transmission is shown at left, with the same part from the 1942 model.*

. . . IN THE DISTRIBUTION OF

Used and Rebuilt Machine Tools

This is an age of specialization. American industry owes much of its growth to the fact that each stage of an industrial operation has been managed by men trained to do one job superlatively well.

The distribution of used machine tools is a *big* and *specialized* industry. Distributors must know market conditions, both local and national. They must know how and what available machine tools can be recommended to fit the production requirements of the customer.

America's leading used machine tool distributors, united in MDNA, offer both government and industry an efficient experienced method of distribution of available surplus machine tools.

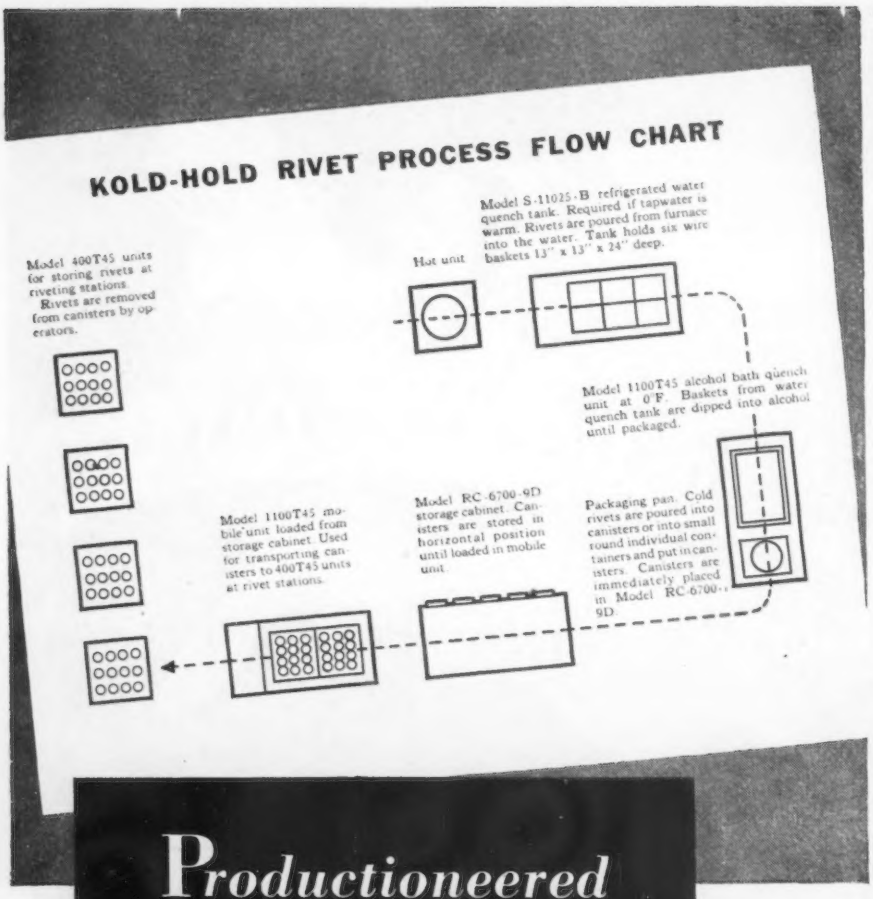
SECOND WARTIME CONFERENCE OF MACHINERY DEALERS NATIONAL ASSOCIATION WILL BE HELD AT HOTEL PENNSYLVANIA, NEW YORK CITY, JUNE 5th and 6th, 1944

The MDNA insignia is a pledge by the used machine tool dealer who displays it that he conducts his business relations in a spirit of fair play to his customers and competitors.

MDNA
MEMBER

MACHINERY DEALERS NATIONAL ASSOCIATION

20 NORTH WACKER DRIVE **CHICAGO (6) ILLINOIS**

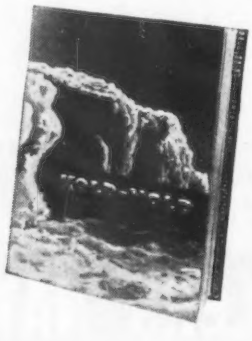

KOLD-HOLD RIVET PROCESS FLOW CHART
Model 400T45 units for storing rivets at riveting stations. Rivets are removed from canisters by operators.
Hot unit
Model S-11025-B refrigerated water quench tank. Required if tapwater is warm. Rivets are poured from furnace into the water. Tank holds six wire baskets 13" x 13" x 24" deep.
Model 1100T45 alcohol bath quench unit at 0°F. Baskets from water quench tank are dipped into alcohol until packaged.
Packaging pan. Cold rivets are poured into canisters or into small round individual containers and put in canisters. Canisters are immediately placed in Model RC-6700-9D.
Model RC-6700-9D storage cabinet. Canisters are stored in horizontal position until loaded in mobile unit.
Model 1100T45 mobile unit loaded from storage cabinet. Used for transporting canisters to 400T45 units at rivet stations.

Productioneered

. . . FOR COST BASED ON EFFICIENCY OF OPERATION

The illustrated rivet process flow chart is a typical demonstration of Productioneering* by Kold-Hold . . . assuring capacity and temperatures best suited to specific cold processing applications and production schedules.

From quench tank to rivet storage machines on the assembly lines, the processing and storing of aluminum rivets is efficiently, quickly and dependably conducted with Kold-Hold Sub-Zero equipment. Each unit is designed to do a specific job, thereby cutting inspection rejects from 10 to 50%. Convenient tube assembly classifies rivets readily, . . . storage units — master and portable — located exactly where they are needed, assures smooth flow of production. . . . Rivets never leave container from quench to final assembly and consequently are always in satisfactory driving condition.



Write for catalog S-Z 431 for full data on this accepted Kold-Hold rivet processing flow system. Kold-Hold engineers will gladly assist in developing a flow chart to fit your specific application.

KOLD-HOLD

**Engineered for Production*

438 NORTH GRAND AVENUE, LANSING 4, MICHIGAN

schools under the program of Vocational Training for War Production Workers, and by the Food Production War Training Program, both of which are administered by the U. S. Office of Education through State Boards for Vocational Education and local public school systems. The next heaviest enrollments were in engineering colleges and universities under the Engineering, Science and Management War Training program, also administered by the U. S. Office of Education.

WMC Training - Within - Industry program was fourth in size of enrollments and National Youth Administration, which has been discontinued, was fifth.

Mr. McNutt's announcement also revealed the extent of the services provided to war industries by WMC's Apprentice Training Service, a constituent agency of the Bureau of Training, and of the Division of Visual Aids for War Training of the U. S. Office of Education.

Training has been supplied by the training agencies to every branch of war industry, including shipbuilding, the aircraft industry, ordnance manufacturers, electrical manufacturers, the chemical industry, transportation, communications, and other essential industries.

Mr. McNutt laid particular stress on the importance of the development of training courses which emphasize better methods of supervision, including human relations, safety, use of materials and machines, absenteeism and labor turnover. He also stressed the importance of the contribution of the public vocational schools, which in the main have followed tested training patterns developed as a part of the trade and industrial education service provided by them for a quarter of a century, and of the colleges in the training of engineers.

Elliott Is New Director of OCR

• • • **William Y. Elliott,** former Harvard University professor, has been appointed director of the Office of Civilian Requirements of WPB.

He succeeds Arthur D. Whiteside, who resigned in February to return to the presidency of Dun & Bradstreet, New York.

Mr. Elliott has been director of WPB's stockpiling and transportation division.

"I got my choice of two bumper crops!"

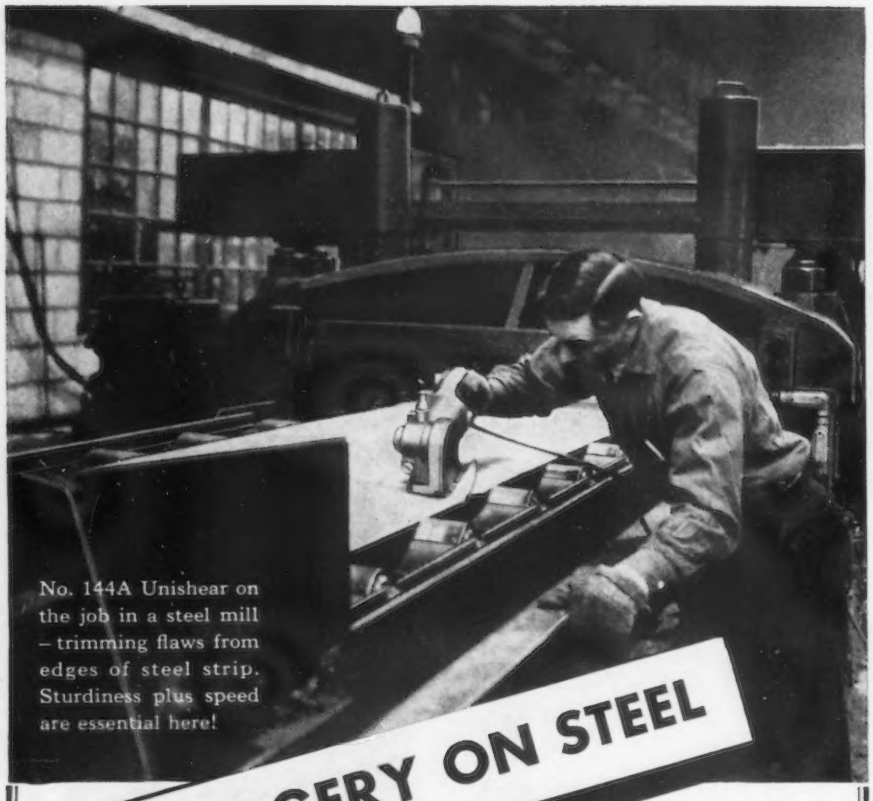
Here's not one, but two right answers on how to get more power bits for less!

FIRST, you can use the regular Apex-Phillips screw driver bits, and when they get worn just send 'em back to the factory and have 'em reconditioned. The cost is a small fraction . . . generally less than one-third . . . of the new bit price. AND renewed Apex bits are good as new, which is plenty good, because they're made of fine steel, heat treated for the right combination of strength and hardness. Get the full story in Catalog No. 15.

OR you can use the new Insert Type Apex bits, with Apex holders. Holders are supplied to fit practically every type and make of power driver. And the holders accommodate the short, money-saving, steel-saving bits in a full range of sizes. You trim your inventory because a few bit sizes fit all holders. You save substantial money. Get the facts in Bulletin No. 102. So take your choice, and either way, make it Apex-Phillips screw driver bits.

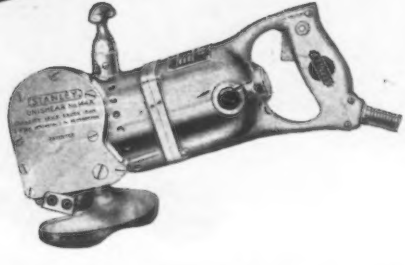
APEX

THE APEX MACHINE & TOOL COMPANY • DAYTON 2, OHIO



No. 144A Unishear on the job in a steel mill – trimming flaws from edges of steel strip. Sturdiness plus speed are essential here!

SURGERY ON STEEL



No spreading cracks or weakening flaws get by this Unishear operator on a steel rolling mill. Defects in the sheet steel are snipped out as they roll by – a product protection afforded by Stanley Unishear's powerful, fast-cutting action. Unishear cuts up to 15 feet per minute as fast as you feed.

Stanley Portable Unishears are made in four models – for 18, 16, 14 and 12 gauge hot rolled steel or galvanized iron. Stationary Unishears – for 14 gauge and 10 gauge sheets. Write for literature. Stanley Electric Tool Division, The Stanley Works, New Britain, Connecticut.

STANLEY

ELECTRIC TOOLS FOR INDUSTRY

Incomes Gain Little Despite Greater Sales

• • • **Despite** a 27 per cent increase in net sales, 490 leading manufacturing and mining corporations had available for dividends in 1943 a net income only slightly greater than in 1942, according to a study just completed by the National Conference Board.

The net sales of these industrial corporations totaled more than $48 billion in 1943 against about $38 billion in 1942. But income before taxes and special reserves was only 12.3 per cent greater and the gain in net income available for dividends was reduced to 4.4 per cent. Dividends paid by some 470 of the companies totaled $1.3 billion in 1943, as compared with $1.2 billion the year before.

A 34 per cent increase in sales was recorded by the 250 durable goods manufacturers included in the board's tabulations. Among these companies, those in the aircraft industry showed the greatest gain and building materials concerns the smallest. The most substantial increase among nondurable goods companies occurred in the rubber manufacturing industry, in which there was a 58 per cent gain in sales volume and an 89 per cent gain in income before taxes and special reserves.

The outstanding decline in taxable income last year, other than that among building equipment concerns, was the loss of 18 per cent in the steel and iron industry, although its net sales were 15 per cent greater than in 1942. Increased labor costs in this industry contributed considerably to the reduction of 7 per cent in its net income after taxes, according to the board.

More Efficient Marine Engines Expected for Merchant Ships

• • • **Higher temperatures** and pressures for propulsion turbines will offer a logical means of obtaining more economical merchant ship operation, especially if the cost of fuel goes up after the war, according to A. Kennedy, Jr., assistant to the manager of General Electric's Federal & Marine Divisions.

In an address April 28 before the Metropolitan Section of the Society of Naval Architects and Marine Engineers in New York City, Mr. Kennedy pointed out that "every increase of approximately 25 deg. in steam temperature for a given pressure means an improvement of ap-

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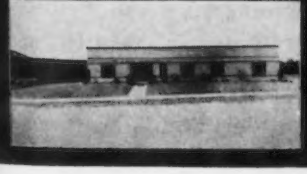
ARMY E NAVY

The Metal Specialty Co. is completely equipped to give efficient service in Stamping, Rolling, Coining, Forming and Annealing in all Metals. Specialists in Hydraulic cold drawing and embossing in all metals including Stainless Steel. Deep drawing and embossing up to 850 tons capacity. Shells drawn up to 20" depth. Assembling including Flash and Resistance Seam Welding. Pressed Metal Products to order.



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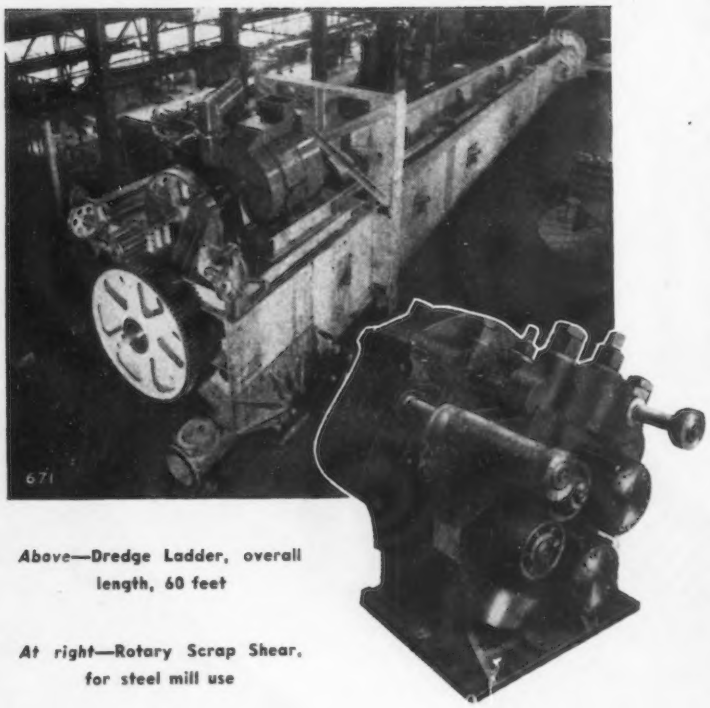
BENDING AND STRAIGHTENING MACHINES • ANGLE BENDERS

Special Machinery



Above—Dredge Ladder, overall length, 60 feet

At right—Rotary Scrap Shear, for steel mill use

THE facilities of the Thomas organization are available for the production of all types of special machinery, both light and heavy.

We also invite your inquiries for contract work, dies, jigs and fixtures. Write for Bulletin 301.

THOMAS MACHINE MANUFACTURING COMPANY

PITTSBURGH, PA.

proximately one per cent in heat rate."

Stating that the Navy has for several years operated a destroyer using 1200 lb., 900 deg. F. steam, Mr. Kennedy indicated that merchant ship turbines can and will be built for those conditions. A great share of the credit for progress up to the present, according to the speaker, is due to a few progressive shipbuilders, naval architects, and operators.

The problem of designing marine turbines for higher pressures and temperatures has been materially simplified for manufacturers who have had years of experience in building similar machines for large central station power plants, Mr. Kennedy said.

Along with higher steam conditions, higher turbine rotative speeds also offer many advantages according to Mr. Kennedy. "Some of these advantages are improved efficiently and shorter spans between bearings, thereby simplifying expansion problems due to temperature. Shorter spans mean fewer alignment problems, smaller shafts and less packing leakage; higher revolutions mean lower weights and tend to lower costs," he said.

WPB Modifies "Special Sales" Rules

Washington

• • • Rules governing special sales of small holdings of finished products under the terms of Priorities Regulation No. 13, have been modified. These rules, as amended May 1, permit the sale of finished products without preference ratings or special authorization if the total amount of all products of the same type and composition which the holder has is worth not more than $100.

Changes have been made in List A which indicates the conditions under which materials may be sold and List B which indicate conditions under which finished products may be sold.

One important change in List A permits the sale of aluminum in controlled material form without priorities to wholesale dealers who are regularly engaged in the business of selling aluminum. Furthermore, aluminum in other than controlled material forms and shapes may be sold without priorities to a user who may use it under WPB regulations.

Regulation No. 13 governs only special sales and does not relate to sales in regular trade channels.

CLOCKED AT LIGHTNING CUTTING-SPEED

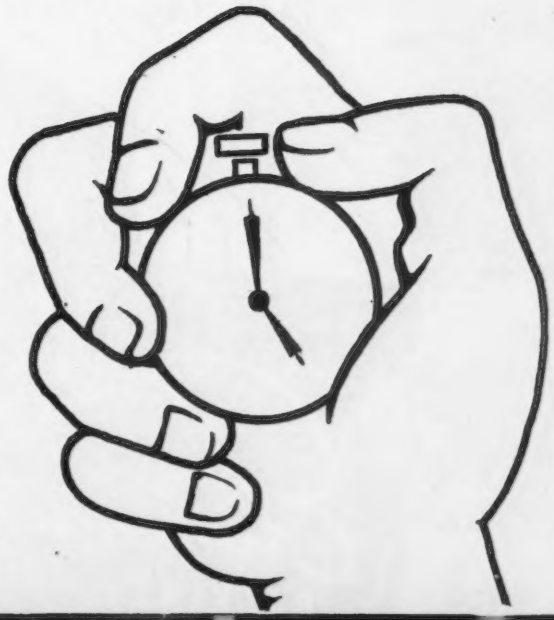
Electro Grinding Wheels

In this production war against time, the response of steel foundries has been vigorous and effective.

We are proud of our contribution to these foundries—increased hourly production of steel castings through the faster cutting action built into Electro Snagging Wheels.

High strength—rugged construction—superior cutting qualities—all have made possible better cleaning room efficiency.

If you haven't seen Electro Wheels perform—if you want faster and cheaper cleaning operations—will you write today for the facts?



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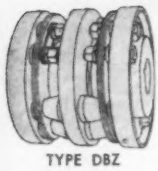
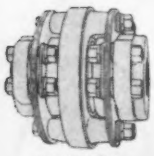
AND ALLOYS CORP.

Vars Building Buffalo 2, N. Y

THOMAS
Flexible COUPLINGS
FOR *any* SPEED OR SERVICE


TYPE DBZ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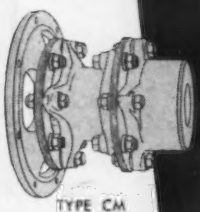
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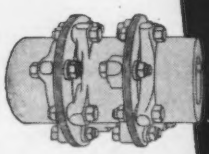
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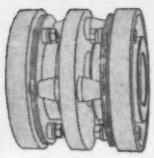
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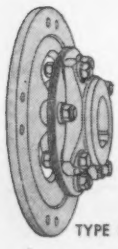
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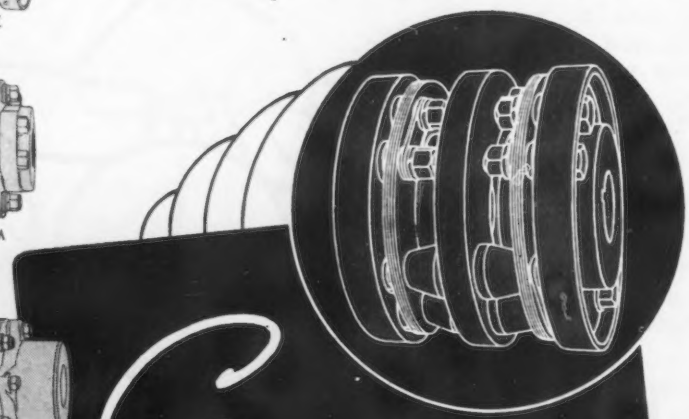

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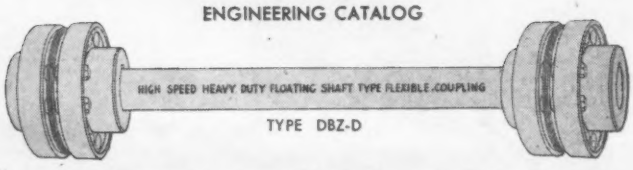

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Machine Tool Builders

(CONTINUED FROM PAGE 110)

ture pointing out how unnecessary and awkward motions could be eliminated by redesign of machines and fixtures. Many adaptations on both mechanical and electrical controls have been made in GM plants to reduce physical effort on the part of the operator to a minimum.

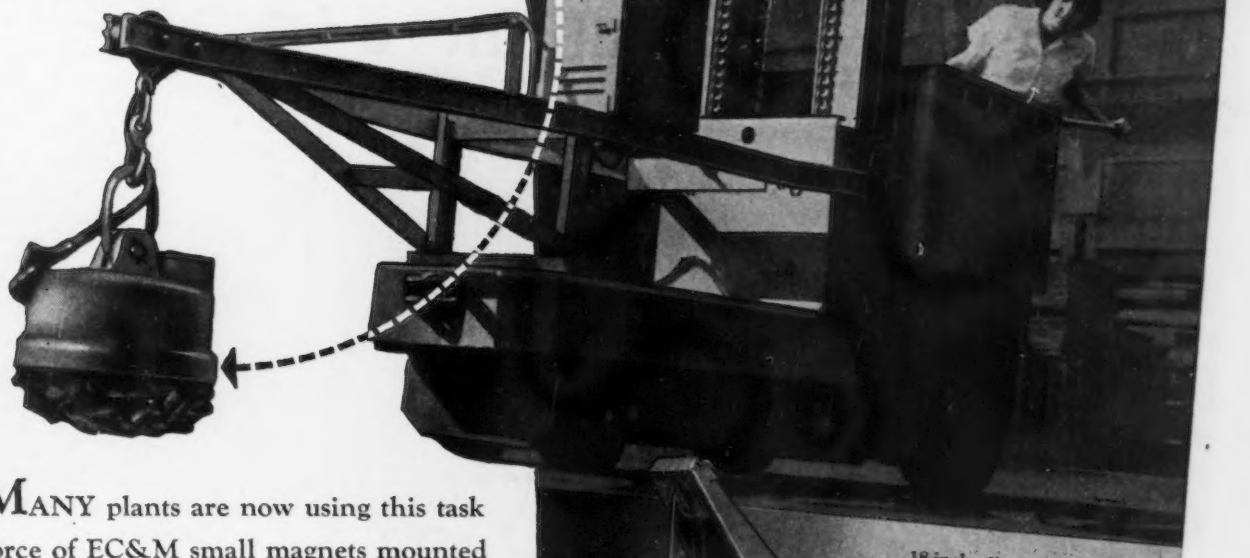
Renegotiation will cost machine tool builders on 1942 business an estimated total of $54 million, of which $14.5 million will be in reduction of postwar refund, according to A. G. Bryant, chairman of the government relations committee of the association and vice-president, Cleereman Machine Tool Co. Without renegotiation, he said, the industry would be left with a net profit of $87 million or 6.6 per cent of total sales volume; with renegotiation, the net profit will be $48 million or 3.6 per cent of sales. If the same ratio should hold for 1943 sales, the net profit for the industry on sales of $1,180 millions would amount to only $42.4 million, as compared with a profit of $68.5 million (without postwar refund), or 5.8 per cent of sales, without renegotiation.

In tracing the efforts his committee has been making in trying to obtain preferential treatment for the machine tool industry because of the necessity of building up postwar reserves, Mr. Bryant indicated that at one time the Senate Finance Committee was prepared to back the amendment to renegotiation legislation exempting the machine tool industry from renegotiation in 1943. The point was lost through a technical error in handling the matter in conference, but having come so close to gaining this unique recognition, the committee has continued its efforts for financial relief of the industry.

Since January the renegotiation of machine tool companies has come under the jurisdiction of the RFC, and Mr. Bryant stated that after repeated conferences with the RFC board he was encouraged as to the prospect for relief and was willing to admit that a phase in the discussions had been reached where "negotiation" was really being carried on. "There has been a freedom of discussion, an openmindedness in acceptance of facts and a readiness to exchange data that for the first time in our experience has inspired confidence that some logical and statesmanlike procedure

INDUSTRY'S TASK FORCE

SMALL MAGNETS on Lift Trucks

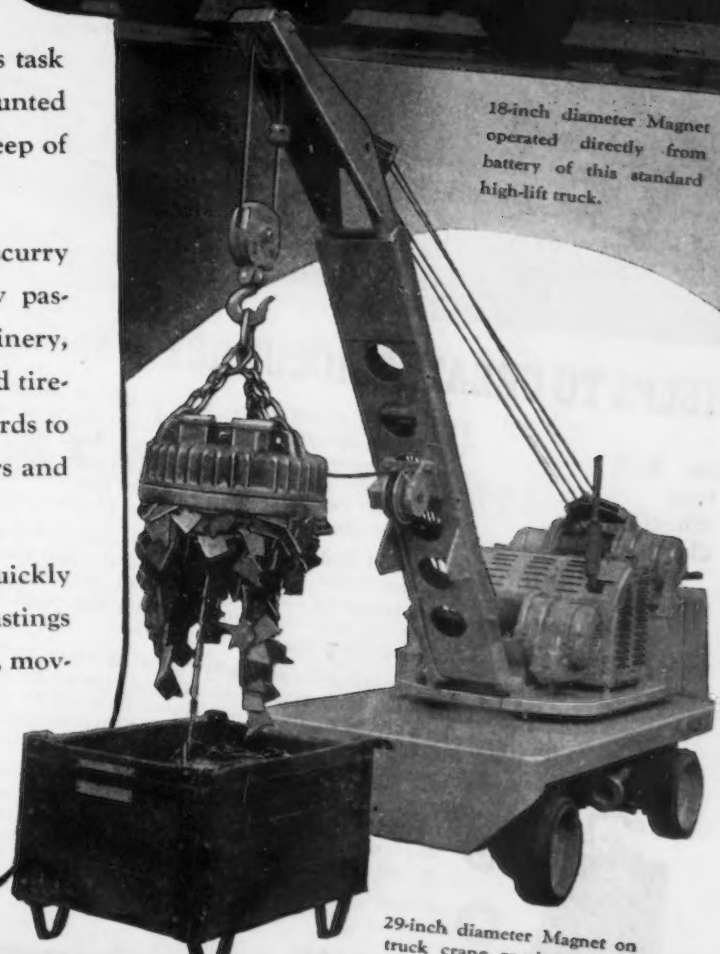


MANY plants are now using this task force of EC&M small magnets mounted on industrial trucks for a clean sweep of production lanes.

These easily handled mobile units scurry around the plant through narrow passages, into the corners, around machinery, picking up bolts, nuts, turnings, and tire-injuring scrap. They "sweep" hazards to men and equipment from the floors and save valuable materials.

They also handle plant materials quickly and at little cost, such as lifting castings and forgings from floor to machine, moving products in and out of boxcars, and other similar lifting and moving jobs about the plant.

18-inch diameter Magnet operated directly from battery of this standard high-lift truck.



29-inch diameter Magnet on truck crane receives 36-volt power directly from truck.

EC&M Circular Magnets come in ten sizes for all industrial needs. Ask for Bulletin **900**

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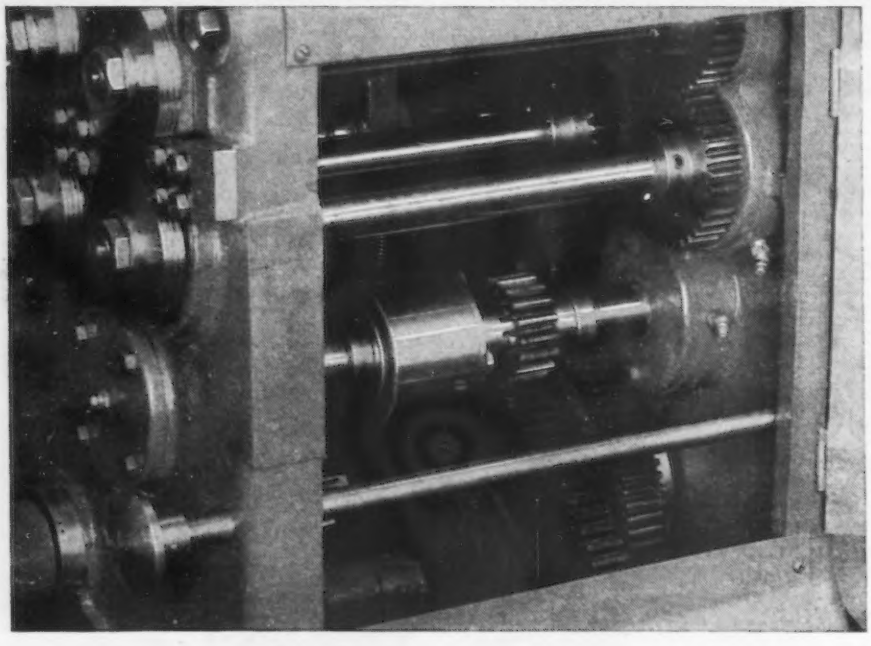


HELPS TO GREATER ACCURACY *in Spring Coiling*

No. 3 Free Wheeling Clutch

The sturdy construction and precision manufacture of Torrington Spring Coilers are the strongest possible guarantees of accuracy in spring coiling. Preservation of inherent accuracy does require, however, preventive maintenance. The following pointers about free wheeling clutches should be observed by every owner of our coilers:

1. Clean and flush once a month with carbon tetrachloride or gasoline. Refill with SAE 10 oil of the best quality. Never use kerosene for cleaning this clutch. In some cases kerosene creates an emulsion, gumming up the parts rather than washing them clean.
2. Flat spots are eventually worn in cams and the clutch becomes inaccurate. Cams for necessary replacements may be ordered or the entire clutch returned to the manufacturer for overhauling. Detailed instructions simplifying re-assembly are furnished by the manufacturer.
3. Worn or improperly operating clutches should be overhauled promptly. Having a spare clutch on hand, especially in plants having more than one coiler of a size, is general practice. Return direct to the manufacturer for best service.
4. Excessively cold temperatures will cause the oil to thicken, hindering free action of the clutch cams.

June 15th—*Spring Length*

THE TORRINGTON
MANUFACTURING COMPANY
TORRINGTON, CONNECTICUT

with respect to our industry may be developed," he added.

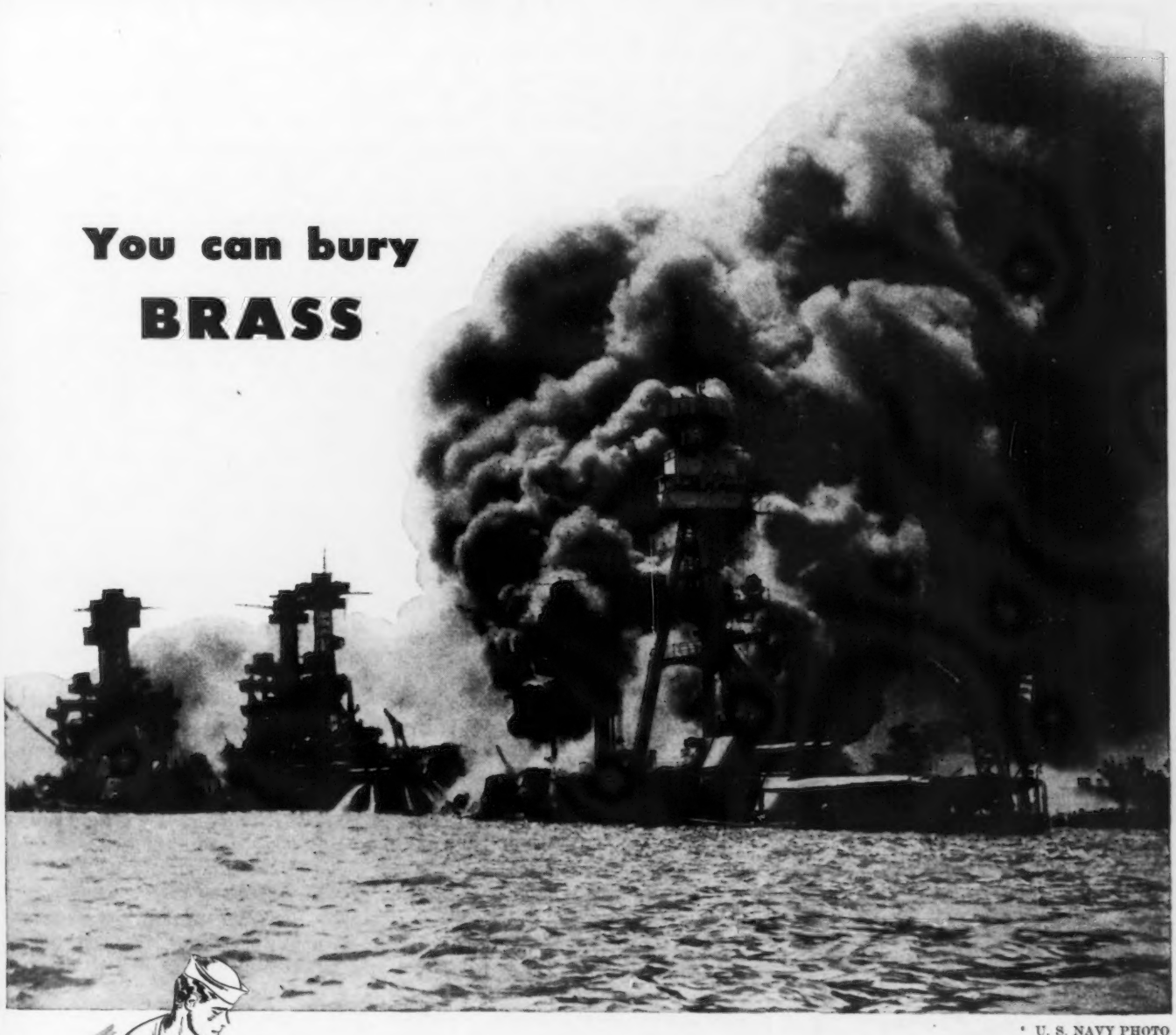
In this connection, Mr. Bryant said that it is not expected that any machine tool builder will be renegotiated for 1943 until the RFC board has arrived at a policy, still under discussion, and until further court action involving DPC sales prior to July 1, 1943, is concluded.

Mr. Bryant was one of several who stressed the necessity of pool orders being re-established by WPB to take care of the present upsurge in orders. The combined inroads of excess profits taxation, renegotiation and reduced gross profits because of higher labor and material costs have eliminated the possibility of the machine tool industry having any reserves on which to support the risks involved in boosting production to levels above $500 million in 1944. During the peak period of war production, a total of about $800 million in pool orders were issued to the machine tool industry, he recounted, and from present indications the unassigned machines ultimately may amount to less than 1 per cent of the total ordered.

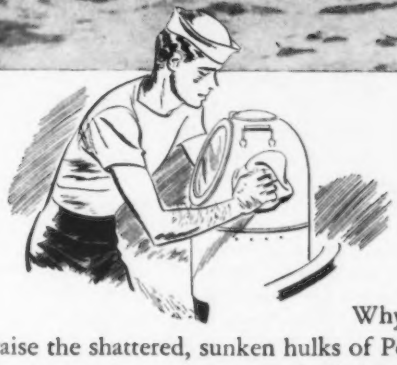
Commenting on the drain of key men by the draft, Mr. Bryant said his committee had constantly pointed out to various government officials that it cannot be taken for granted that machine tool builders can be converted to other work, be shorn of financial reserves, be stripped of key manpower and at any moment of emergency in the future "work another miracle" as they did in the past.

Summarizing the policies proposed by the planning committee of the NMTBA in regard to disposition of government owned machine tools, William P. Kirk, vice-president, Pratt & Whitney, stated that the first step is for the armed services to decide what plants, what arsenals and what equipment in dead storage must be retained for national defense, keeping in mind that the best equipment should be retained and the obsolete machines scrapped. The second consideration is the use of surplus machines to improve the manufacturing efficiency of this country so as to make possible the continuance of high wages and a high standard of living and yet retain a world market for U. S. goods. Mr. Kirk declared that there are about 605,000 machine tools in this country over 14 years old and hence obsolete, whereas there will only be about 400,000 modern machine tools available after the war,

You can bury BRASS



* U. S. NAVY PHOTO



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Why work like beavers to raise the shattered, sunken hulks of Pearl Harbor? Two reasons . . . scrap and salvage. And always among the topmost items on the salvage list are the ship's "brightwork," piping, precision instruments, and other costly gear . . . which are Brass in part or entirety.

Unless battle-damaged, this equipment is usually salvageable and *readily renewable* because of this unique characteristic of Naval Brass: No other metal or alloy is so agelessly defiant of the inroads of corrosion. In fact, Brass raised from months or years in a watery grave can be restored with almost magical ease and speed to its former unspotted brilliance. So Brass is a lifelong protector of public funds in the shape of taxes, securities, and war bonds.

Thousands of sea-miles of Naval Brass have rolled from the mills at Bristol since the Spanish-American War. And many more thousands of miles of Bristol Brass sheet, rod, and wire . . . in various alloys for every military purpose from shells to hospital equipment . . . are rolling out now. But one day soon, this golden flow will be diverted back to peacetime products . . . such, perhaps, *as your own* . . . if machinability, "form-ability," corrosion-resistance, and handsome richness of color are factors in your production and marketing plans. At your service, at any time.

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Using Strenes Metal, we'll cast your dies to shape, (usually to 1/16") and save you around 50% to 75% on machinery time. What's more you'll put to work a die that will stand up—draw and form far more stampings than you probably believe possible. Deep draw runs of 1,000,000 and more parts a matter of record.

You'll be using a die that will require redressing far less frequently than dies of ordinary metal. Sounds good, but, hard to believe, you say! Perhaps. But our suggestion stands "Toss us that tough one" and pay for it when Strenes makes good as claimed—otherwise there will be no charge.

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Strenes
METAL
DRAWING AND
FORMING DIES

assuming that the armed services will first be taken care of.

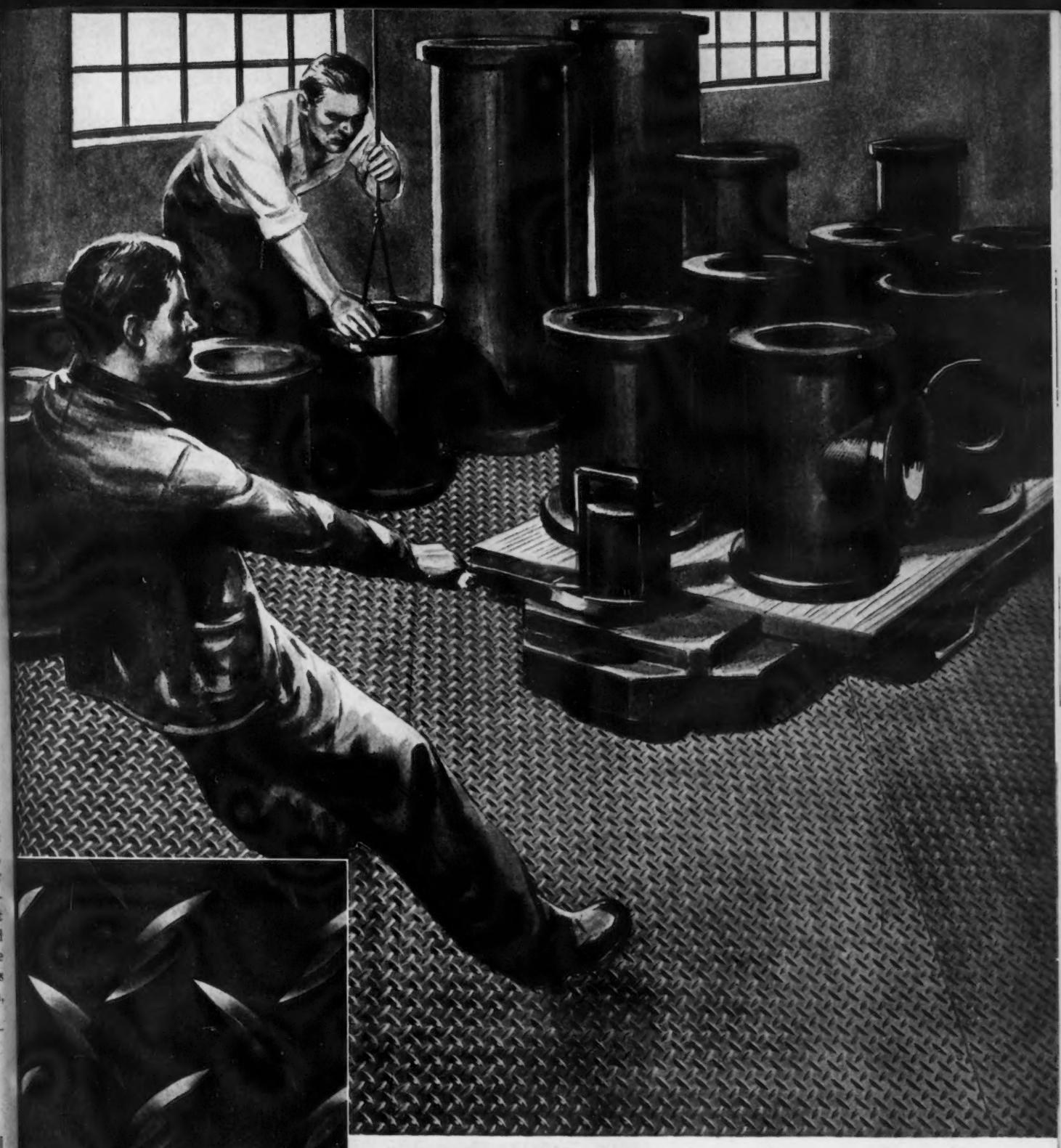
The third consideration is the disposal of surplus tools. For the sake of simplicity, Mr. Kirk said the necessity for appraisal must be avoided because it takes too much time and requires highly experienced men. Instead the price should be based on the original price with a discount for service usage. The planning committee has suggested a discount of 25 per cent plus 1 per cent for each month of the machine tool's age past the date of shipment, with a maximum discount of 55 per cent, applied to machines 2½ years old or older. The committee thought that auctioneering would be time consuming and that the pressure to sell large volumes of machines would inevitably depress their prices far below their actual value. Since speed is the important consideration in the transition from war to peace production, Mr. Kirk proposed that as machines became idle, even though the war has not ended, they should be disposed of so that contractors can change over piecemeal and not leave the entire problem for the eventual end of hostilities.

Within a few weeks, a new maximum price regulation will be issued to replace MPR 67, according to William F. Kelly, price executive, machinery branch, OPA. The new regulation is essentially the same as before and continues to use Oct. 1, 1941, as the base date for prices on tools, parts and attachments. It will, however, clear up the existing confusion regarding pricing of new items and parts which have been under MPR 136. Any impressions that parts are covered by March, 1942, base date are erroneous, Mr. Kelly stated. Under the new regulation, the pricing of new items is essentially the same as given in MPR 136 except that reports of estimated costs and of actual production experience are required and the new price is frozen after the second order for the same machine.

Mr. Kelly defended the OPA policy of requiring manufacturers to absorb increase in labor rates and material costs, particularly in pricing new items, on the basis that there would be no price control if manufacturers were allowed to pass on their increased costs—merely a freezing of profit percentages. Increases in maximum prices on individual items can be obtained only when the price is so low that continued production of an essential product is threatened. Mr. Kelly maintained, however, that no case has been reported to his office where OPA prices acted as an impediment to production of a product needed for the war program or for essential civilian use.

Analysis of the source and nature of postwar machine tool demand, both domestic and foreign, should be done on the basis of each company's type of product rather than on an overall basis, according to Walter K. Bailey, chairman of the committee on sales and service, and vice-president, Warner & Swasey Co. The postwar need for machine tools of a particular manufacturer is going to be met out of surpluses plus new orders and it is up to each builder to study the question of surplus machine tools with respect to his peculiar situation,

INVASION OIL: *These U. S. Army oil tank cars somewhere in England wait to be put into use with a large quantity of other railroad rolling stock which will keep supplies moving forward when the invasion of Europe gets underway.*



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SUGGESTION SYSTEM DIVISION
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Mr. Bailey said. Questions arising with respect to such surpluses include whether or not a company should make a profit by retooling them, giving engineering service free or at a charge, rebuilding equipment, etc. One of the most important questions, according to the speaker, is whether or not a company will accept the responsibility of servicing its machines when they change ownership. He expects a stupendous service job having to be done to adapt these surplus machines to peacetime requirements.

While rebuilding may have many possibilities, Mr. Bailey insisted that new design is the only long term answer to continued satisfactory postwar sales. Like Mr. Scott, he stressed that the only reason people buy machine tools is to cut manufacturing costs and hence this factor should be uppermost in the minds of designers. Mr. Bailey suggested that the entire sales and advertising policy of the industry be keyed to the fundamental principle that the machine tool builders are in business to make what their customers want, namely machines to cut manufacturing costs.

That recent losses to the draft have been costly and discouraging to the machine tool industry was admitted by John S. Chafee, director of the WPB tools division, who called attention to the recent upturn in orders. Although rigid screening of orders is still being followed, production of machine tools will be sustained at present levels for several months to come, he said. Shipments for the first quarter amounted to $158 million and the backlog at the end of the period was $153 million. Preliminary estimates indicate that April net orders were above those of March, which showed a sharp gain over February.

Since much of the equipment being currently ordered involves special tools, Mr. Chafee suggested the salvaging of standard units, such as spindles, unit feed heads, motors, etc., from surplus machinery, although he admitted that little progress has been made on this score. As regards supply of components, Mr. Chafee reported that the production of anti-friction bearings was still a major problem, particularly in the case of special bearings. Cutting tools are easier but the supply of die head chasers is tight. The speaker concluded by saying that in view of the manpower situation and the shortages mentioned, it would not be safe to divert engineering and toolmaking talent toward retooling for future peacetime production, although he indicated that pressure from the automotive industry was considerabe on this score.

CAN MAKERS GO TO WAR: Here are samples of the products of the can manufacturers that are being used to help fight the war. Items ranging from intricately designed smoke floats to ammunition carriers and plasma containers are shown here. These products are all made by the American Can Co.

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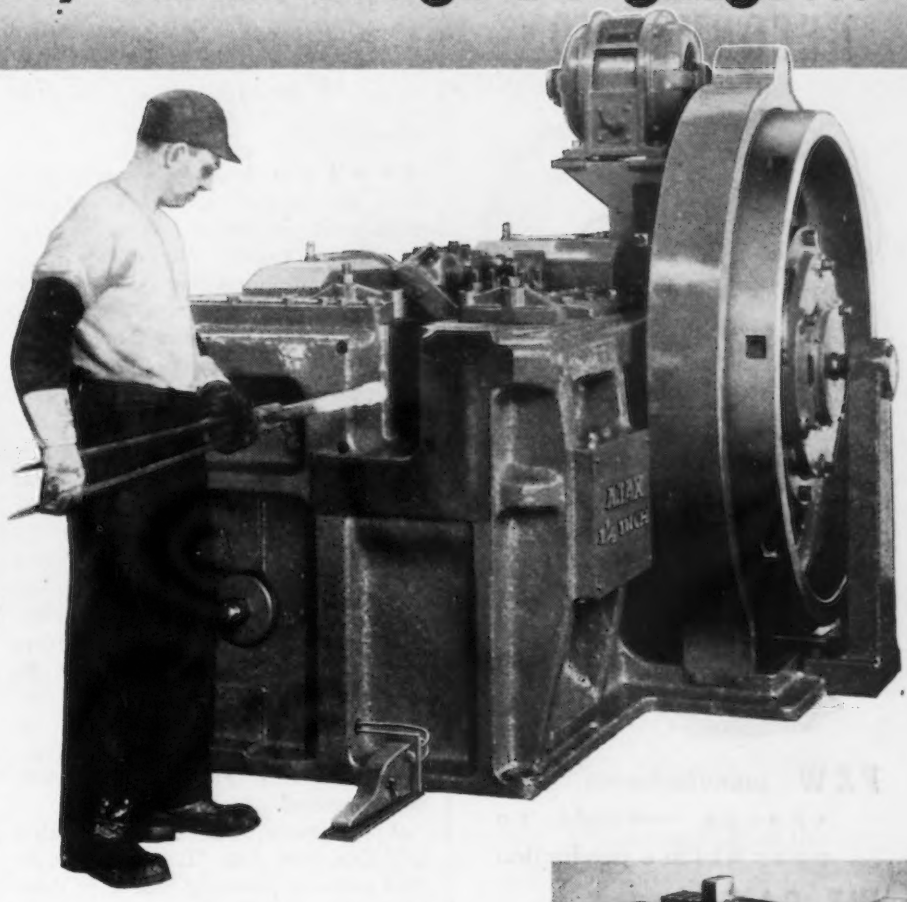

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Excellent examples are the forgings illustrated, with the dies and tools in which they were forged.

Socket wrenches of standard hexagon type, and the more exacting double hexagon type, are forged so accurately that close fits on nuts and bolt heads are provided without subsequent broaching.

The slender, tapered sockets of carpenters chisels, with thin tapering wall, are deep pierced with close concentricity and uniformity, comparing favorably with the screw machine product.

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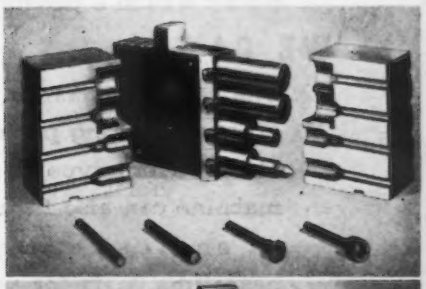

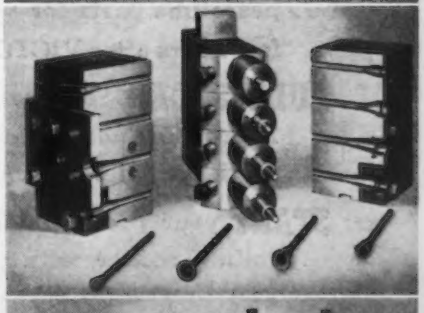

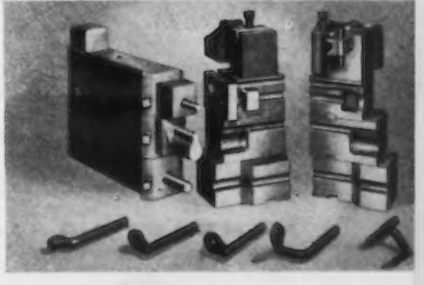

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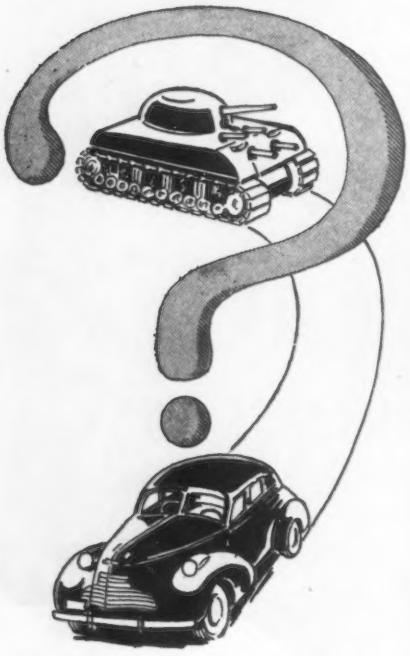
WHAT SPEED
RECONVERSION



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Postwar Planning Premature, Says Westinghouse Official

Cleveland

• • • **A new theme in** postwar planning was discernible from the recent statements of two industrial figures; F. D. Newbury, vice-president of Westinghouse, and Joseph W. Frazer, president of Warren City Mfg. Co., Warren, Ohio. This new thought narrows down to: "Postwar planning is a little premature since there is still a hard shooting war to be produced for and won and, it's too bad more planning cannot be done silently so war winning morale is not affected."

Westinghouse's Newbury told the Machine Tool Electrification Forum at Pittsburgh that Westinghouse has purposely delayed planning in deference to the war effort and considers that there is still plenty of time. In fact planning now is starting to appear strictly premature because of the numerous uncertainties involved. Some general planning was, however, recommended.

J. W. Frazer, in a recent discussion told THE IRON AGE, "It is unfortunate that postwar planning cannot be done silently to aid the prosecution of the war. It is affecting production through a lowering of workers' incentive and is causing absenteeism."

Discussing the postwar plans of the Warren City company, Mr. Frazer said that it would make anything that could be produced with the equipment and would sell. Due to the heavy nature of equipment, the fields to be entered would probably include railroads (particularly on diesel motive equipment), ships' mechanical equipment and heavy mill equipment.

Mr. Newbury scoffed at the term postwar planning, saying that it is in reality long term planning based upon more guesswork than usual. He said the only basis for firms continuing in their own line of products is to analyze past business trends and moderate these with current trend guesses. The effects of new markets and new products on all trends, he said, were very confusing to the prophets, which included himself.

He stated that the postwar volume aims of Westinghouse would be to attain 60 per cent of its wartime billing which constitute 175 per cent of normal peacetime billings for the company. He stressed that this attainment was hoped for over a period of several years following the close of the war, but certainly not immediately after the war. The high and low points of the normal business cycle are still anticipated and the effects of taxes, politics and other business regulating factors are considered.

In postwar employment Newbury expects heavy demands on the consumer durable goods fields but expects some capital goods fields to suffer a drop of 75 per cent in personnel requirements.

High labor rates are definitely seen by Mr. Newbury in the postwar period which will require better management and equipment. Labor rates in one line alone were cited by Mr. Newbury as having increased on an hourly basis between 1914 and 1944 from 25c. per hr. to $1.23 per hr., without any increase in the list price of the product.

Labor saving equipment was seen as helpful to the situation for production items but not of much assistance for heavy machinery and other non mass production item manufacturers. Regaining low operating costs appears to be the greatest postwar problem for all industries.

Western Electric Takes Over DPC Plant in Scranton, Pa.

• • • **Under an agreement** reached May 11, the Western Electric Co. will take possession of the Defense Plant Corp.'s factory at Scranton, Pa. This will enable the company to transfer a portion of its wire and wire-products operations from its works in Baltimore.

Finishing operations on wire, cords and cable, according to Western Electric, will give employment to about 1000 people most of whom will be women. Shipments from Scranton will begin within 60 days, it is estimated.

COMING EVENTS

May 25—American Iron and Steel Institute, New York.

June 5-7—SAE National War Materiel Meeting, Detroit.

June 5-7—American Society of Refrigerating Engineers, Pittsburgh.

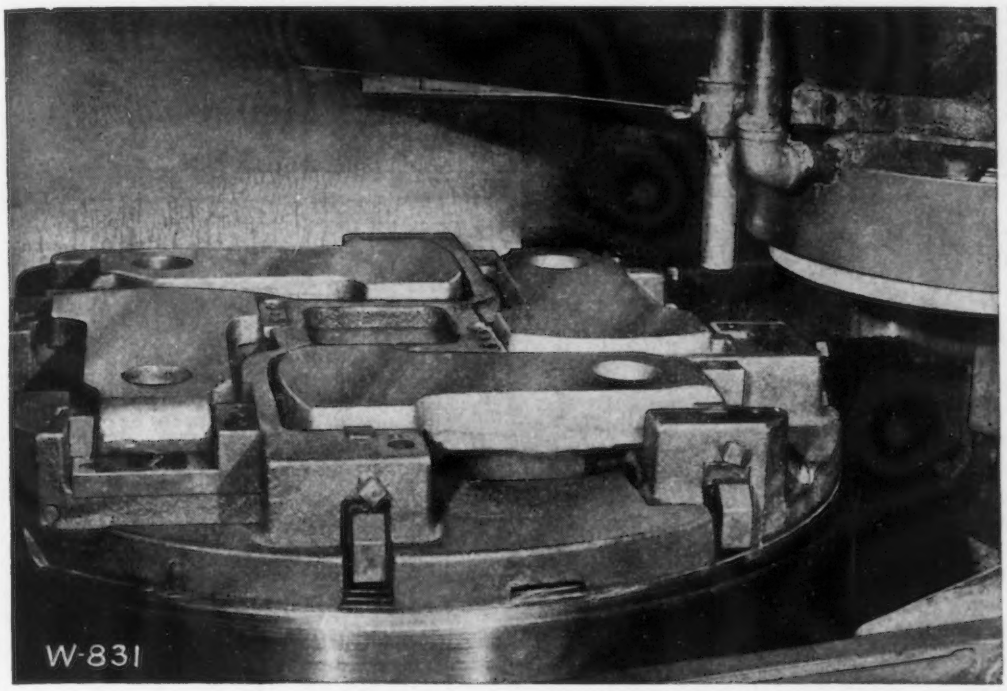
June 19-22—American Society of Mechanical Engineers, Pittsburgh.

Oct. 5-7—SAE National aircraft engineering & production meeting, Los Angeles.

Oct. 5-6—AIME Electric furnace steel conference, Pittsburgh.

Oct. 16-18—AIME Fall meeting, iron and steel division, Cleveland.

Dec. 4-6—SAE National air cargo meeting, Chicago.



The advantages of BLANCHARD *grinding*

★*Production*

Adaptability

Fixture Saving

Operation Saving

Material Saving

Fine Finish

★*Flatness*

Close Limits

★*Production* ★*Flatness*

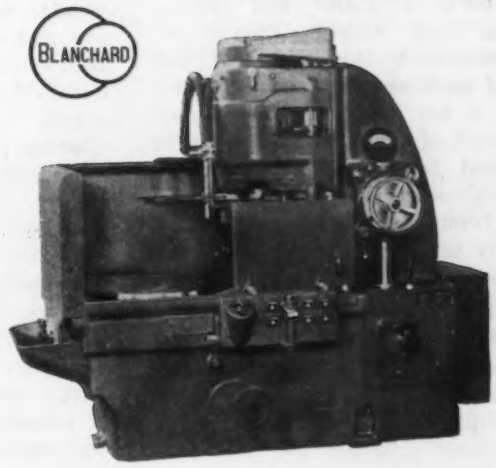
Crankshaft Cheeks ground from the rough

These crankshaft cheeks of tough alloy steel are ground from the rough forging removing .080" stock from the surface at the rate of 12 pieces per hour.

This job is typical of many production jobs in which the Blanchard grinds the first surface on the rough casting or forging, making a dependably flat surface from which all later operations can be located.

"Put it on the Blanchard"

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.



This job being done on the No. 18 Blanchard Surface Grinder

The
BLANCHARD MACHINE COMPANY

64 State St., Cambridge 39, Mass.

MACHINE TOOLS

. . . News and Market Activities

Tool Needs for Shell Program Revealed

Cleveland

• • • **Machine tool** builders received their first preview of the size of the new Army tool contracts related to the heavy caliber shell program when the War Department's administrator of machine tools and methods, Robert R. Stephens, outlined the scope and urgency of their task before the Machine Tool Builders Association meeting here last week.

The machine tool program alone stacks up to approximately 2000 new machines having an estimated value of about $16 million, although the total equipment program necessitated by the shell contracts may total $150 million when forging equipment, heat treating furnaces, conveying equipment and other necessities are included. Tools, gages, marking equipment and other essential incidentals are also omitted from the above estimate.

Tool builders are somewhat disgruntled by the fact that the Army will not accede to the demands to place tool orders for the required machine tools so that production schedules could be developed and subcontracting be utilized on a sound basis. As the matter stands, builders' shops are busy, in part at least, with parts programs and subcontracting and without definite information as to the number of each type of machine which should be produced, it has been hard to estimate what part of their facilities must be converted to new tool production, what subcontracting must be eliminated from their shops and in what quantity to subcontract work for the new tools which each is expected to produce, when overall quantities are not known.

To overcome this difficulty as far as possible and to provide a working table of machine tool quantity requirements for the shell program, THE IRON AGE is publishing below the estimated number of each type of machine needed. These are official War Department estimates. The one joker in the figures is the fact that the quantities listed may be exactly doubled within the next three months. Deliveries of the tools listed are wanted immediately and through the last of August and there is the possibility that a duplicate number may be requested for delivery by Jan. 1.

155 mm. Shell Tooling Requirements

Operation	No. of Machines
Centering	162
Facing and cut-off	160
Rough turning	249
Finished turning	160
Nosing	64
Nose boring	160
Band grooving	130
Finished turn, facing	130
Threading nose	*
Band setting	150

* 130 tappers would be desirable but the shortage of chasers may require the use of different and as yet an undecided type of equipment.

The above estimate does not include shot blasting, painting, marking and similar equipment which will be purchased.

8-In. Shell Tooling Requirements

Operation	No. of Machines
Centering	26
Cut-off, facing	47
Rough turning	101
Nosing	8
Nose boring	22
Finish turning	72
Band grooving	43
Face base	22
Nose thread	14
Turn band	11
Turn bourrelet	14

•

Greenfield Tap & Die Reports for 1943

• • • **The 1943 report** of the Greenfield Tap & Die Corp. discloses several "lame ducks" were disposed of during that year, including its wholly owned Greenfield Tap & Die Corp. of Canada, Ltd., its New York salesroom and warehouse (on which it has taken a lease), and its interest in the Greenfield Homes Corp., a realty project.

During 1943 the working force was reduced from 3902 to 2970. Since January, 1944, the company has closed the tap plant opened in July, 1942, and has turned back to the DPC some of its equipment and cash advances received in 1942 from the government to purchase cutting tools and gages.

After setting aside $2,020,000 for tax reserves and $200,000 for postwar contingency reserve, the company wound up 1943 with a net profit of $442,811, equal to $2.04 a common share after preferred dividends, as compared with $510,828, or $2.43 a common share in 1942. At the close of 1943 the company had current assets of $7,197,864 and current liabilities of $4,481,163.

Could This Be?

• • • Last week the Japanese Domei agency said that large quantities of Japan's idle spinning machines are being converted into lathes and other types of machine tools by experts of the Ohmi Aircraft Co. after months of experimenting, according to U. S. government monitors. The Ohmi company's plants were said to be using frames, rails, gears, roller and ball bearings, nuts, bolts, springs, shaft bearings and other parts of spindles for the construction of machine tools. The Munitions Ministry was described as supporting the conversion of other spinning mills. There was no indication as to what influence this conversion of spinning equipment would have on the Japanese textile industry, whose production output has caused some concern in Japan. A Tokyo broadcast in June, 1943, said 40 per cent of the Japanese textile industry had been abolished as a war necessity.

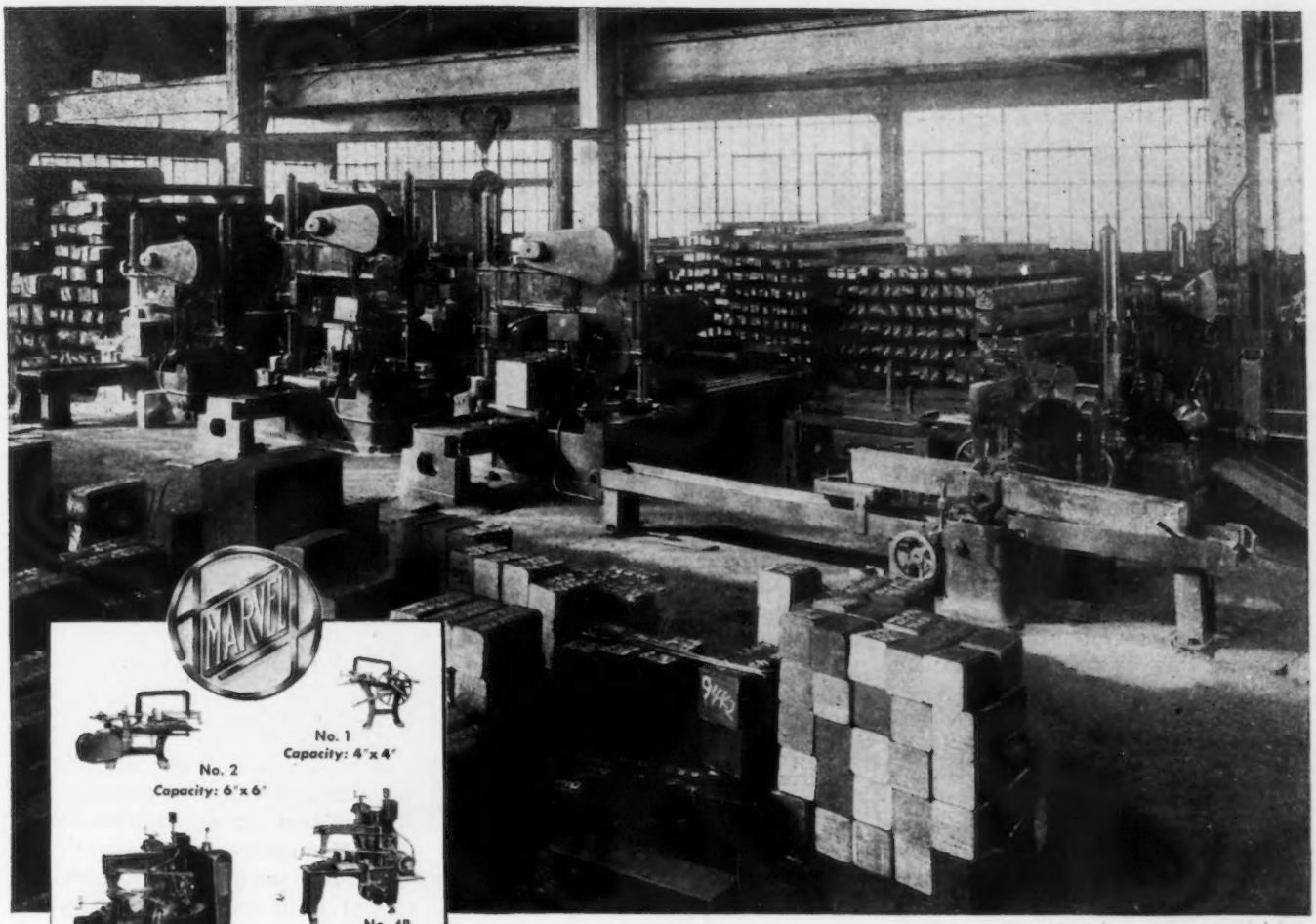
Cincinnati Interests Now Control Cleveland Automatic

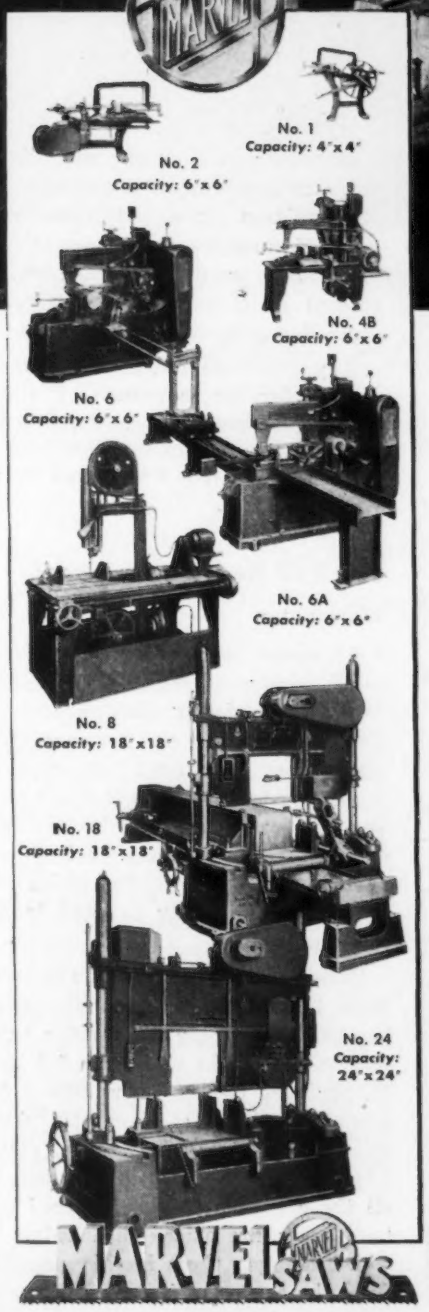
Cleveland

• • • **Control of** the Cleveland Automatic Machine Tool Co. was taken over at the annual stockholders meeting on May 10 by Cincinnati interests represented by Harold R. LeBlond who takes the post of president and director and Edward G. Schultz as vice-president, treasurer and director. Col. James Hammond, who acquired control of the concern in 1941, was elected chairman of the board.

Harold LeBlond is also president of the LeBlond Engineering Co. of Cincinnati and son of R. K. LeBlond of the R. K. LeBlond Machine Tool Co. Mr. Schultz is treasurer of the R. K. LeBlond firm. The Cleveland Automatic plant is to be operated as a separate rather than a subsidiary interest of the LeBlond concern.

Other officers elected include: C. Blake McDowell, Akron, Ohio attorney, re-elected secretary and a director; Ralph Tyler, Jr., Cleveland, assistant secretary; E. F. Suchy, Cleveland, re-elected assistant treasurer and Carl M. Jacobs and James J. Laughlin, directors.





2 men now do the work of 4 and save forging steel too

The Ajax Steel & Forge Company, Detroit, has solved its cutting-off problems with a battery of MARVEL Saws. Before, billets were cut-off with a hammer—an operation which not only required at least four men and tied up hammers and furnaces, but also resulted in the waste of a great deal of forging steel.

Now two operators with seven Marvel Saws supply the entire plant with billets cut to exact size from bars up to 18" x 18" square. In addition to their present Marvel Saws, five of which are illustrated above, this company is adding a super-giant MARVEL No. 24 Hydraulic Hack Saw—the new mammoth saw that quickly cuts off the toughest steels in sizes up to 24" x 26" cross section.

Our local MARVEL Sawing Engineer will gladly call at your plant, study your metal cutting problems and make recommendations as to methods and equipment. Write for new Catalog.

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Ave. **Chicago 39, U. S. A.**

Eastern Sales Offices: 225 Lafayette St., New York, N. Y.

NON-FERROUS METALS

. . . News and Market Activities

No Cutbacks in Foreign Copper Output

Washington

• • • **The British Copper position** has eased sufficiently for the United Kingdom to plan reducing its purchases of copper from Northern Rhodesia and other sources of supply, according to a statement on the international copper situation issued by the Combined Raw Materials Board. The United States position, however, the board said, has continued to be tight, and this situation has grown worse by the prospective decline in copper production in this country because of manpower shortage.

It was stated that the whole question of copper supplies in 1944 has been under review and that it has been decided that in order to safeguard the allied nations' copper position, production from all sources should be maintained as far as practicable. Any production from sources hitherto allocated to the United Kingdom in excess of that country's agreed requirements, the board pointed out, will be made available in 1944 to the United States or Russia as may be arranged in agreement with the appropriate authorities of the countries concerned.

•

Copper Output Declines

• • • **Production of crude** copper in April because of labor shortages at the mines and smelters declined more than 9200 tons to 92,037 net tons, lowest monthly output since February, 1942, according to statistics released by the Copper Institute. Refinery production amounted to 95,280 tons, down 3838 tons from March output of 99,118 tons. April deliveries of 155,877 tons, however, were equally as heavy as that shipped in March, when 156,083 tons were delivered to customers.

•

New Rules for Al Ingot

• • • **Rules governing procedures** under which users of aluminum ingot may obtain it have been consolidated into a single document, Direction No. 49 to Controlled Materials Plan Regulation No. 1, WPB announced May 11.

The rules point out that aluminum ingot may be delivered only to fill authorized controlled material orders and certain AM (aluminum and magnesium) orders.

Ingot may be delivered to fill authorized controlled material orders that are:

1. Placed by the War Department bearing the symbol "W" or "O" (the War Department will order ingot for use in its own establishment only).

2. For export under a program of the Foreign Economic Administration. Such orders will bear allotment numbers in the "E" or "L" series and may be placed by the U. S. Treasury Department or by other persons on the basis of export licenses.

3. Identified by CMP allotment numbers of which the first four digits follow in the series S-2950 through S-2975. Allotments are made in this series only for destructive or similar direct uses of aluminum. Applications for such allotments should be made on Form WPB-2360 to the War Production Board, Washington.

4. Identified by the CMP allotment symbols MRO-P-43 (Maintenance, Repair & Operating Supplies) or V-9. These symbols are used by persons purchasing aluminum ingot for experimental purposes under Order P-43.

5. For use in casting patterns for foundries that do not have AM authorization numbers. These orders should be designated "MRO patterns."

No other CMP allotment symbols or numbers will be acceptable as authority for shipment of aluminum ingot. In any instance where a consumer wishes to purchase aluminum with the MRO symbol for other than the above specified uses, he will be referred to the Ingot Section of the Aluminum and Magnesium Division.

Ingot may be delivered to fill orders bearing AM numbers in the following series:

AM-0100 through AM-0499, usable by producers and smelters of aluminum ingot.

AM-0500 through AM-0599, usable by aluminum powder manufacturers.

AM-1000 through AM-1099, usable by producers of aluminum rolled rod and bar.

AM-1100 through AM-1199, usable by producers of aluminum rolled structural shapes.

AM-3000 through AM-3999, usable by aluminum forge shops.

No other AM authorization numbers are acceptable for the shipment of aluminum ingot, but orders bearing AM numbers in the series indicated above must be accepted and respected as if they were authorized controlled material orders.

Any questions concerning authorizations for the movement of aluminum ingot should be addressed to the Ingot Section, Aluminum and Magnesium Division, War Production Board, Washington 25.

•

Tin Mill Restrictions Eased

Washington

• • • **Minor amendments,** including small order exemptions, of order M-21-e, restricting the use of tin plate, terne plate and tin mill black plate, were announced last week by WPB. Added to Schedule A are component parts for air cleaners and closures for steel drums. Schedule A specifies the extent to which tin and terne plate may be used in the listed products.

Other changes in Schedule A raise from 4 to 6 lb. the permitted coating per base box on long ternes for automotive fuel tanks and from 1.3 to 4 lb. per base box on short ternes for roofing repair. Hot dipped tin plate, electrolytic plate and terne plate, where total annual consumption of all these grades does not exceed 100 base boxes, are placed on Schedule B, which exempts them in this quantity from the controls of order M-21-e.

Copper Statistics

(in net tons)

U. S. Duty Free Copper	Production Crude*	Production Refined	Deliveries to Customers	Refined Stocks End of Period
Year 1941	1,016,996	1,065,667	1,545,848	75,564
Year 1942	1,152,344	1,135,708	1,635,236	65,309
Year 1943	1,194,699	1,206,871	1,643,677	52,121
4 Months 1944	384,463	374,307	538,271	38,382
1943				
November	99,340	102,136	138,881	52,027
December	98,568	104,644	115,850	52,121
1944				
January	95,424	92,781	101,779	45,800
February	95,713	87,128	124,532	36,489
March	101,289	99,118	156,083	37,259
April	92,037	95,280	155,877	38,382

*Mine or smelter production or shipments and custom intake including scrap.

from the Copper Institute

NICKEL ALLOYS AID THE CHEMICAL INDUSTRY

to KEEP 'EM PRODUCING!

Stainless Steel Lined Polymerization Reactors in Synthetic Rubber Plant

Equipment of Stainless Steel, Nickel and Monel meets many specialized requirements

Chemical engineers have met America's wartime challenge.

They opened the gates to a mighty flood of products going to war... strategic raw materials, synthetic substitutes, and entirely new substances having advantages all their own.

A factor in this production success is the wide use of stainless steel, Monel, and other corrosion-resistant alloys containing Nickel.

For in the chemical industry corrosion is a large-scale menace.

To wage war on this enemy, chemical engineers enlisted the aid of Nickel, because Nickel imparts to other metals strength and resistance to corrosion and wear. In the chemical field, as in many others, a little Nickel goes a long way to keep equipment producing.

It prolongs the life of processing apparatus, and protects the purity, color, and uniformity of the product.

Hence, stainless and Nickel alloys are specified widely for acid heaters and caustic coolers, for high-pressure autoclaves and vacuum evaporators, for cracking towers and polymerization reactors, for shipping drums and tank cars, for pumps, piping and storage tanks, for agitators and settlers, for stills and digestors—for every type of equipment that converts laboratory experiments into full-scale chemical operations.

For years we have enjoyed the privilege of cooperating with technical men of the chemical industry... and of many others. Whatever your industry may be ... if you want help in the selection, fabrication, and heat treatment of alloys ... we offer you counsel and data.

New Catalog Index

New Catalog C makes it easy for you to get Nickel literature. If gives you capsule synopses of booklets and bulletins on a wide variety of subjects—from industrial applications to metallurgical data and working instructions. Why not send for your copy of Catalog C today?

* Nickel *

THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall St., New York 5, N. Y.*

REFINER, SMELTER PRICES

(Cents per lb. unless otherwise noted)

Aluminum, 99+%, del'd	15.00
Aluminum, No. 12 Fdy., (No. 2)	12.00
Aluminum, deoxidizing grades	11.00 to 12.25
Antimony, Asiatic, New York	Nominal
Antimony, American, f.o.b. Laredo, Tex.	14.50
Arsenic, prime white, 99%	4.00
Brass, 85-5-5-5 ingots (No. 115)	13.00
Cadmium, del'd	90.00
Cobalt, 97-99% (dollars per lb.)	$2.11
Copper, electro, Conn. Valley	12.00
Copper, electro, New York	11.75
Copper, lake	12.00
Copper, beryllium, 3.75-4.25% Be; dollars per lb. contained Be	$15.00
Gold, U. S. Treas., dollars per oz.	$35.00
Indium, 99.5%, dollars per troy oz.	$7.50
Iridium, dollars per troy oz.	$165.00
Lead, St. Louis	6.35
Lead, New York	6.50
Magnesium, 99.9+%, carlots	20.50
Magnesium, 12-in. sticks, carlots	30.00
Mercury, dollars per 76-lb. flask, f.o.b. shipping point or port of entry	$191 to $193.00
Nickel, electro	35.00
Palladium, dollars per troy oz.	$24.00
Platinum, dollars per oz.	$35.00
Silver, open market, New York, cents per oz.	44.75
Tin, Straits, New York	52.00
Zinc, East St. Louis	8.25
Zinc, New York	8.67

Copper, Copper Base Alloys

(Mill base, cents per lb.)

	Extruded Shapes	Rods	Sheets
Copper	20.87	....	20.87
Copper, H.R.	....	17.37	....
Copper, drawn	....	18.37	....
Low brass, 80%	....	20.40	20.15
High brass	....	....	19.48
Red brass, 85%	....	20.61	20.36
Naval brass	20.37	19.12	24.50
Brass, free cut	....	15.01	....
Commercial bronze, 90%	....	21.32	21.07
Commercal bronze, 95%	....	21.53	21.28
Manganese bronze	24.00	....	28.00
Phos. bronze, A, B, 5%	....	36.50	36.25
Muntz metal	20.12	18.87	22.75
Everdur, Herculoy, Olympic or equal	....	25.50	26.00
Nickel silver, 5%	....	28.75	26.50
Architect bronze	19.12	....	.

Aluminum

(Cents per lb., subject to extras on gage, size, temper, finish, factor number, etc.)

Tubing: 2 in. O.D. x 0.065 in. wall 2S, 40c. (½H); 52S, 61c. (O); 24S, 67½c. (T).

Plate: 0.250 in. and heavier; 2S and 3S, 21.2c.; 52S, 24.2c.; 61S, 22.8c.; 24S, 24.2c.

Flat Sheet: 0.188 in. thickness; 2S and 3S, 22.7c. a lb.; 52S, 26.2c.; 61S, 24.7c.; 24S, 26.7c.

2000-lb. base for tubing; 30,000-lb. base for plate, flat stock.

Extruded Shapes: "As extruded" temper; 2000-lb. base. 2S and 3S, factor No. 1 to 4, 25.5c.; 14S, factor No. 1 to 4, 35c.; 17S, factor No. 1 to 4, 31c.; 24S, factor No. 1 to 4, 34c.; 53S, factor No. 1 to 4, 28c.; 61S, factor No. 1 to 4, 28½c.

The factor is determined by dividing perimeter of shape by weight per lineal foot.

Wire Rod and Bar: Base price; 17ST and 11ST-3, screw machine stock. Rounds: ¼ in., 28½c. per lb.; ½ in., 26c.; 1 in., 24½c.; 2 in., 23c. Hexagonals: ¼ in., 34½c. per lb.; ½ in., 28½c.; 1 in., 25½c.; 2 in., 25½c. 2S, as fabricated, random or standard lengths, ¼ in., 34c. per lb.; ½ in., 25c.; 1 in., 24c.; 2 in., 23c. 24ST, rectangles and squares, random or standard lengths, 0.093-0.187 in. thick by 1.001-2.000 in. wide, 33c. per lb.; 0.751-1.500 in. thick by 2.001-4.000 in. wide, 29c.; 1.501-2.000 in. thick by 4.001-6.000 in. wide, 27½c.

Magnesium

Sheet, rod, tubes, bars, extruded shapes subject to individual quotations. Metal turnings: 100 lb. or more, 46c. a lb.; 25 to 90 lb., 56c.; less than 25 lb., 66c.

NON-FERROUS SCRAP METAL QUOTATIONS

(OPA basic maximum prices, cents per lb., f.o.b. point of shipment, subject to quality, quantity and special preparation premiums)

Copper, Copper Base Alloys

OPA Group 1

No. 1 wire, No. 1 heavy copper	9.75
No. 1 tinned copper wire, No. 1 tinned heavy copper	9.75
No. 2 wire, mixed heavy copper	8.75
Copper tuyeres	8.75
Light copper	7.75
Copper borings	9.75
No. 2 copper borings	8.75
Lead covered copper wire, cable	6.00*
Lead covered telephone, power cable	6.04
Insulated copper	5.10*

OPA Group 2

Bell metal	15.50
High grade bronze gears	13.25
High grade bronze solids	11.50*
Low lead bronze borings	11.50*
Babbitt lined brass bushings	13.00
High lead bronze solids	10.00*
High lead bronze borings	10.00*
Red trolley wheels	10.75
Tinny (phosphor bronze) borings	10.50
Tinny (phosphor bronze) solids	10.50
Copper-nickel solids and borings	9.25
Bronze paper mill wire cloth	9.50
Aluminum bronze solids	9.00
Soft red brass (No. 1 composition)	9.00
Soft red brass borings (No. 1)	9.00
Gilding metal turnings	8.50
Contaminated gilded metal solids	8.50
Unlined standard red car boxes	8.25
Lined standard red car boxes	7.75
Cocks and faucets	7.75
Mixed brass screens	7.75
Red brass breakage	7.50
Old nickel silver solids, borings	6.25
Copper lead solids, borings	6.25
Yellow brass castings	6.25

OPA Group 3

Yellow brass soft sheet clippings	8.625
Yellow rod brass turnings	8.375
Zincy bronze borings	8.00
Zincy bronze solids	8.00
Fired rifle shells	8.25
Brass pipe	7.50
Old rolled brass	7.00
Admiralty condenser tubes	7.50
Muntz metal condenser tubes	7.00
Plated brass sheet, pipe reflectors	6.50
Manganese bronze solids	7.25[1]
Manganese bronze solids	6.25[2]
Manganese bronze borings	6.50[1]
Manganese bronze borings	5.50[2]

OPA Group 4

Automobile radiators	7.00

OPA Group 5

Refinery brass	5.00*

*Price varies with analysis. [1] Lead content 0.00 to 0.40 per cent. [2] Lead content 0.41 to 1.00 per cent.

Other Copper Alloys

Briquetted Cartridge Brass Turnings	8.625
Cartridge Brass Turnings, Loose	7.875
Loose Yellow Brass Trimmings	7.875

Aluminum

Plant scrap, segregated

All S-type alloys (except 2S)	8.50
2S solids	8.00
High grade alloys	7.00
Low grade alloys	6.50
Borings and turnings	
High grade alloys	5.50
Low grade alloys	5.00

Plant scrap, mixed

All solids	6.00
Borings and turnings	4.00

Obsolete scrap

Pure cable	8.00
Old sheet and utensils	7.00
Old castings and forgings	6.50
Pistons, free of struts	6.50
Pistons, with struts	4.50
Old alloy sheet	5.50

For old castings and forgings, pistons, sheets, add ½c. lb. for lots 1000 to 19,999 lb.; for other scrap add 1c.; for lots over 19,999 lb. add 1½c. a lb.

Magnesium

Segregated plant scrap

Pure solids and all other solids, exempt	
Borings and turnings	8.00

Mixed, contaminated plant scrap

Grade 1 solids	11.00
Grade 1 borings and turnings	7.00
Grade 2 solids	9.00
Grade 2 borings and turnings	5.00

For lots over 1499 lb. add 1c. per lb.

Zinc

New zinc clippings, trimmings	7.25
Engravers', lithographers' plates	7.25
Old zinc scrap	5.75
Unsweated zinc dross	5.80
Die cast slab	5.80
New die cast scrap	4.95
Radiator grilles, old and new	4.95
Old die cast scrap	4.50

Lead

Deduct 0.55c. a lb. from refined metal basing point prices or soft and hard lead inc. cable, for f.o.b. point of shipment price.

Nickel

Ni content 98+%, Cu under ½%, 26c. per lb.; 90 to 98% Ni, 26c. per lb. contained Ni.

ELECTROPLATING ANODES AND CHEMICALS

Anodes

(Cents per lb., f.o.b. shipping point)

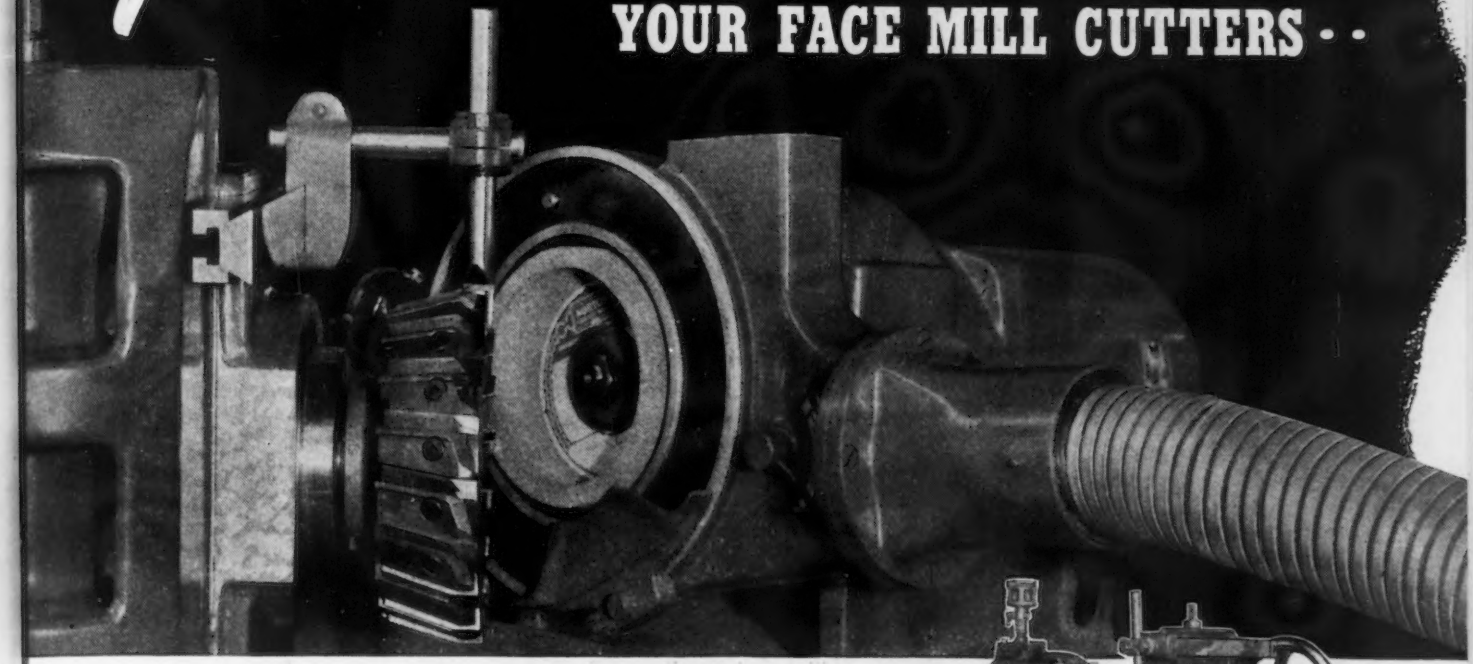
Copper: Cast, elliptical, 15 in. and longer	25⅛
Electrolytic, full size	22⅞
cut to size	30⅛
Rolled, oval, straight, 15 in. and longer	23¼
Curved	24¼
Brass: Cast, 82-20, elliptical, 15 in. and longer	23⅝
Zinc: Cast, 99.99, 16 in. and over	16¼
Nickel: 99% plus, cast	47
Rolled, depolarized	48
Silver: Rolled, .999 fine per Troy (1-9) oz., per oz.	58

Chemicals

(Cents per lb., delivery from New York)

Copper cyanide, tech., 100-lb. bbls. 1-5	5.65
Copper sulphate, 99.5 crystals, bbls.	13.00–13.50
Nickel salts, single, 425-lb. bbls.	34.00
Silver cyanide, 100 oz., lots	40.82–41.125
Sodium cyanide, 96% dom., 100-lb. dms.	0.15
Zinc cyanide, 100-lb. dms.	33.00
Zinc, sulphate, 89% crystals, bbls.	6.80

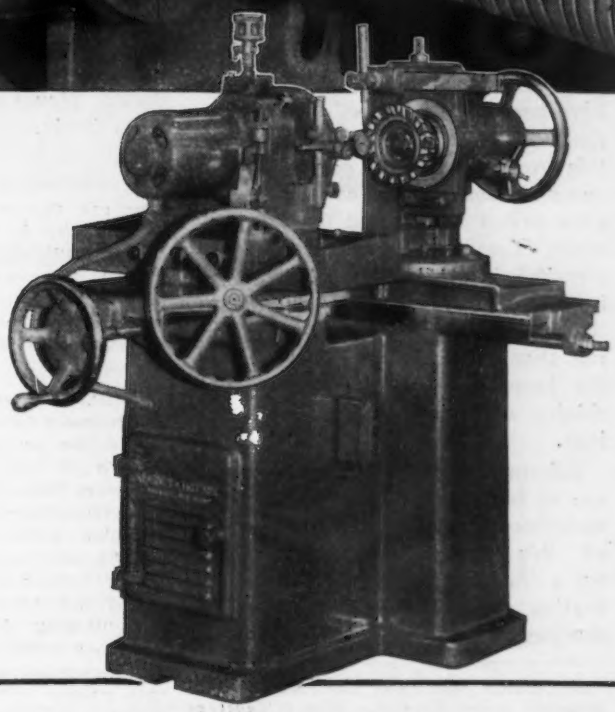
Increase PRODUCTIVE TIME BETWEEN GRINDS ON YOUR FACE MILL CUTTERS · ·



. . . Assure a Greater Return From Your Milling Machine Investment

Avoid waste of valuable productive time by constant changing of face mill cutters. The Milwaukee Face Mill Grinder sharpens each tooth accurately — makes cutters last longer — require less frequent regrinding — decreases "down-time" on your milling machines.

An indispensable machine of strength, precision and capacity, the Milwaukee Grinder grinds Tungsten Carbide and other cutters, ranging from 3 inch to 16 inch diameters, to within .0002 runout — and does it fast.



MILWAUKEE FACE MILL GRINDER FEATURES:

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- Accuracy to within .0002 runout
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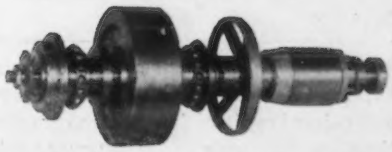

- Set-ups quickly made with graduated dial, facilitating quick adjustments

For complete information write for Bulletin 41-A

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Milwaukee Face Mill Grinder
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•
Milwaukee Speedmill

SCRAP

Scrap Supplies Generally Are Meeting Demand Despite Past Predictions

New York

• • • **Dire predictions** of severe scrap shortages that would effect the total output of steel adversely apparently were more to bolster morale than to warn the steel industry or the scrap industry of a real shortage. While there has been no surplus of the better grades of open hearth scrap, there have been no shortages that have cut steel production. On the other hand, consumers have been getting considerably more "choosey" on what they take in, and as far as such grades as turnings are concerned, they are actually setting up severe specifications on what will be accepted in the way of analyses.

Turnings for the past several weeks have been far in excess of consumption. Price ceilings have broken on this grade at several points, and in many instances mills have completely gone out of the market for this material. That this grade should be so plentiful is easily understood when it is considered that war plants throughout the country are machining thousands of tons of steel, and the by-product of almost any machining operation is the light turnings.

Efforts of the WPB to increase the use of turnings in steelmaking have undoubtedly done much to help drain off this ever-accumulating supply, but a limit can be reached on the proportion of turnings to other scrap charges in steel making. In some instances, mills have reached this limit, but it is believed that some mills are not using turnings in as high proportions as they might. Of course, this undesirable type of scrap will not be used when better scrap is available unless its use is made mandatory.

Dissension concerning the shipment of shipyard scrap from the West Coast to midwest steel plants is analyzed by the West Coast editor in this week's summary of developments in that area on page 96.

Open hearth grades seem to be in sufficient supply to meet the demand of steel producers in practically all steelmaking areas. In fact, it was only a week or so ago that one eastern mill refused to pay the entire springboard for open hearth grades, simply because the supply of this scrap was a little on the plentiful side. Likewise, low phos scrap is in plentiful supply. Dealers of low phos in several areas are finding no buyers, even though this grade still maintains its ceiling prices.

A new note to help ease any scrap shortages that may occur in the South came this week with shipments of baled can scrap from Birmingham's new DPC detinning plant. Tin cans are shredded, cleaned and detinned and then pressed into bales and sold as No. 2 black bundles. Of course the tin, in the form of tin oxide, is recovered and shipped to reducing plants for reconversion into metallic tin.

•

PITTSBURGH—Open hearth supplies here are tighter with dealers in some cases finding it difficult to keep up with demand. Slightly better demand in other districts or some grades such as turnings make these items far from easy. Dealers low phos is still finding no buyers under that label.

•

CHICAGO—Some easing is reported in shipments of heavy melting steel to mills, and dealer activity continues to be restricted by labor shortage. Mill inventories are indicated as adequate for short term requirements, with buyers carefully watching military developments before making long range commitments. Awarding of further shipbuilding contracts on the West Coast is regarded as an omen of continuing shipments from that section, thus assuring a future cushion. Seasonal railroad scrap, although in less than normal volume, adds to supply adequacy. Price concessions continue in blast furnace, stainless and alloy grades, and short shoveling turnings.

•

BUFFALO — Machine shop turnings are still a burning question in the local trade, with a big consumer claiming a purchase at $13.75 a ton, 75c. below the code figure, and another banning further deliveries temporarily. The latter is cleaning up his supply in which a fire developed. Little scrap is coming out and dealers report nearly all items moving readily. Dealers looking ahead fear serious consequences through lack of labor if the war goes into another year, few men being available for preparing scrap.

•

BOSTON—Further rejections of turnings are reported. In one instance the shipper claims to have taken a cut of $5 a ton. On the other hand, shoveling turnings are being taken by melters on a $12.05 a ton, Boston basis. Material moving includes No. 1 cupola cast, stove plate, low phosphorus plate scrap and a little machinery cast, all at ceilings. Breakable cast is still urgently needed and scarce. While machine tool builders are more active they do not average much more than 30 or 40 per cent of a normal scrap output.

•

PHILADELPHIA—Mills here have instituted or are contemplating the establishment of stricter analyses of incoming turnings since alloy contaminations have become quite serious in some cases. Where this new plan is already underway, rejects have been quite heavy. In addition to the meeting of stricter specifications, turnings last week were quite a headache to move as several mills had either gone out of the market or restricted incoming shipments. There has been no change in the refusal of purchasers to pay all or part of the springboard for turnings and open hearth grades.

•

BIRMINGHAM—Cans from Birmingham's new detinning plant, classed as No. 2 black bundles after they have been detinned and pressed, are helping the open hearth scrap situation to some extent in this area. Blast furnace grades have eased off with a Republic Steel Corp. furnace here being taken out of blast for rebuilding.

•

CINCINNATI — The market in this area continues to be at about a steady keel. With one mill out of the market definitely, other mills in the area are taking whatever material is shipped to them, but pressure on specifications continues to be strong. While all dealers are sticking strongly to ceiling prices, they are finding some difficulty with allocated material, in that consumers are not particularly eager to pay the springboard provided under the present schedules.

•

MILWAUKEE—Members of the Wisconsin Scrap Iron Dealers' Association, at a dinner in Milwaukee, were asked, in a talk by Henry M. Syeussy, chief of the local war production board, to put greater efforts to get unused and dilapidated buildings torn down as the steel frame work, piping and other material in them help make the best steel. He also urged the men to urge turning in and breaking up of obsolete machinery.

•

ST. LOUIS—Melters about hold their own in point of scrap inventories, but receding supplies are expected with advent of summer. Arrivals from country are held to a minimum by manpower shortage, preoccupation of farmers with spring work and transportation disabilities incident to record floods in this region. Mills react more strongly on high freight charges on remote scrap.

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★ ★ ★

IRON AND STEEL (OTHER THAN RAILROAD) SCRAP

(All Prices Are Per Gross Ton)

	BASIC OPEN HEARTH GRADES		BLAST FURNACE GRADES				ELECTRIC FURNACE, ACID OPEN HEARTH AND FOUNDRY GRADES									
							Low Phos.		Heavy Structural and Plate			Foundry Steel				
	No. 1 & 2 Hvy. Melt. No. 1 Cp. Blk. Shts. No. 1 & 2 Bundles No. 1 Busheling	Unbaled* Machine Shop Turnings	Mixed Borings and Turnings	Cast Iron Borings	Shovelling Turnings	No. 2 Busheling	Billet, Bloom, Forge Crops	Bar Crops, Punchings Plate Scrap and Cast Steel	3 ft. and Under	2 ft. and Under	1 ft. and Under	2 ft. and Under	1 ft. and Under	Auto. Springs, and Crankshafts	Alloy Free Low Phos. and Sulphur Turnings	Heavy Axle and Forge Turn. First Cut	Electric Furnace Bundles
Pittsburgh, Brackenridge, Butler, Monessen, Midland, Johnstown, Sharon, Canton, Steubenville, Warren, Youngstown, Weirton	$20.00	$15.00	$15.00	$16.00	$17.00	$17.50	$25.00	$22.50	$21.50	$22.00	$22.50	$21.50	$22.00	$21.00	$18.00	$19.50	$21.00
Cleveland, Middletown, Cincinnati, Portsmouth	19.50	14.50	14.50	15.50	16.50	17.00	24.50	22.00	21.00	21.50	22.00	21.00	21.50	20.50	17.50	19.00	20.50
Chicago, Claymont, Coatesville, Conshohocken, Harrisburg, Phoenixville, Sparrows Point	18.75	13.75	13.75	14.75	15.75	16.25	23.75	21.25	20.25	20.75	21.25	20.25	20.75	19.75	16.75	18.25	19.75
Ashland, Ky.	19.50	14.50	14.50	15.50	16.50	17.00	24.50	22.00	21.00	21.50	22.00	21.00	21.50	20.50	17.50	19.00	20.50
Buffalo, N. Y.	19.25	14.25	14.25	15.25	16.25	16.75	24.25	21.75	20.75	21.25	21.75	20.75	21.25	20.25	17.25	18.75	20.25
Bethlehem, Pa.; Kokomo, Ind.	18.25	13.25	13.25	14.25	15.25	15.75	23.25	20.75	19.75	20.25	20.75	19.75	20.25	19.25	16.25	17.75	19.25
Duluth, Minn.	18.00	13.00	13.00	14.00	15.00	15.50	23.00	20.50	19.50	20.00	20.50	19.50	20.00	19.00	16.00	17.50	19.00
Detroit, Mich.	17.85	12.85	12.85	13.85	14.85	15.35	22.85	20.35	19.35	19.85	20.35	19.35	19.85	18.85	15.85	17.35	18.85
Toledo, Ohio	....	12.85	12.85	13.85	14.85	15.35	....	....	....	....	....	....	....	....	....	....	....
St. Louis, Mo.	17.50	12.50	12.50	13.50	14.50	15.00	22.50	20.00	19.00	19.50	20.00	19.00	19.50	18.50	15.50	17.00	18.50
Atlanta, Ga.; Alabama City, Ala.; Birmingham, Los Angeles, Pittsburg, Cal; San Francisco	17.00	12.00	12.00	13.00	14.00	14.50	22.00	19.50	18.50	19.00	19.50	18.50	19.00	18.00	15.00	16.50	18.00
Minnequa, Colo.	16.50	11.50	11.50	12.50	13.50	14.00	21.50	19.00	18.00	18.50	19.00	18.00	18.50	17.50	14.50	16.00	17.50
Seattle, Wash.	14.50	9.50	9.50	10.50	11.50	12.00	19.50	17.00	16.00	16.50	17.00	16.00	16.50	15.50	12.50	14.00	15.50

* Baled turnings are $5 per gross ton higher.

BUNDLES: Tin can bundles are $4 below dealers' No. 2 bundles; No. 3 bundles are $2 less than No. 1 heavy melting.

AT NEW YORK CITY or Brooklyn, the maximum shipping point price is $15.33 for No. 1 heavy melting, f.o.b. cars, f.a.s. vessel or loaded on trucks. Minimum set at $14 per gross ton at any shipping point in U. S. Other grades carry differentials similar to those in table. New Jersey prices must be computed on basis of all-rail. At Boston the maximum is $15.05 for No. 1 f.o.b. cars, f.a.s. vessel or loaded on trucks. Shipments from a New England shipping point to a consumer outside New England carry maximum transportation charge of $6.66 per ton.

SWITCHING CHARGES: Deductions for shipping points within basing point (cents per gross ton) are: Chicago, 84c.; Pittsburgh, Brackenridge, 55c.; Detroit, 53c.; Midland, Johnstown, Sharon, Youngstown, Warren, Weirton, Cleveland, Toledo, Los Angeles, San Francisco, Pittsburg, 42c.; Seattle, 38c.; Buffalo, Claymont, Harrisburg, 86c.; Atlanta, Birmingham, 32c.; Butler, Monessen, Canton, Steubenville, Cincinnati*, Portsmouth, Ashland, Coatesville, Phoenixville, Bethlehem, Kokomo, Duluth and St. Louis, 28c.; Alabama City, Ala., 26c.; Minnequa, Colo., 22c.; Middletown, 14c.; Conshohocken, Sparrows Point, 11c.

*Basic open hearth and foundry grades, and auto springs and crankshafts, deduct 80c. per ton.

BASING POINT includes switching districts of city named.

Basing point	Switching districts:
Pittsburgh	Bessemer, Homestead, Duquesne, Munhall, McKeesport
Cincinnati	Newport
St. Louis	Granite City, E. St. Louis, Madison, Ill.
Chicago	Gary
Claymont	Chester, Pa.
San Francisco	So. San Francisco, Niles, Oakland

MAXIMUM SHIPPING POINT PRICE: Where shipment is wholly or partially by rail or vessel, or combination of rail and vessel, the scrap is at shipping point when placed f.o.b. railroad or f.a.s. vessel. For motor vehicle shipments scrap is at shipping point when loaded. Then maximum shipping point price shall be: (a) For shipping point located within a basing point, prices shown in above table for scrap at basing point in which shipping point is located, minus applicable switching charge deduction shown in paragraph above labeled "Switching Charges." (b) For shipping points outside basing point, price listed in above table hereof for scrap at most favorable basing point, minus lowest charge for transportation from shipping point to such basing point by rail or water carrier or combination. Where vessel movement is involved, in lieu of established dock charge or any cost customarily incurred at the dock, 75c. per ton must be included as part of deduction in computing shipping point price; 50c. at Memphis; $1 at Great Lakes ports; and $1.25 at New England ports. If no established transportation rate exists for a portion of movement from shipping to basing point, actual charge or cost customarily incurred by shipper in such portion of movement shall be included as part of deduction in computing shipping point price. For exceptions see official order.

UNPREPARED SCRAP: For unprepared scrap, maximum prices shall be $3.50 (and in the case of the material from which No. 1, No. 2, and No. 3 bundles are made $4) less than maximum prices for the corresponding prepared scrap. In no case, however, shall electric furnace, acid open hearth and foundry grades be used as the corresponding prepared scrap. A preparation-in-transit charge for unprepared scrap is provided.

NEW LISTED GRADES: Priced in dollars per gross ton less than No. 1 heavy melting steel. Pit scrap, ladle skulls, slag reclaim, etc., of 85% or more Fe priced less $2; 75 to 85% Fe less $4; under 75% Fe less $8 per ton. Mill scale less $8 per ton. Mill cinder and grindings, shipping point maximum price of $4 per gross ton at all U. S. shipping points.

CHEMICAL BORINGS: No. 1 (new, clean, containing not more than 1% oil), $1 less than No. 1 heavy melting; No. 2 (new, clean, containing not more than 1.5% oil), $2 less than No. 1 heavy melting. If loaded in box cars add 75c. mill scale, $8 less than No. 1 heavy melting.

Tool Steel Scrap Prices (MPR 379)

	SEGREGATED		
		Solids Per Lb. Cont. W	Turnings Per Lb. Cont. W
Type 1.	12% min. W, 1% max. Mo	$1.80	$1.60
Type 2.	5 to 12% W, 1% max. Mo	1.60	1.40
Type 3.	1 to 5% W, 1.5% max. Mo	1.25	1.25
*Type 4.	7% min. Mo, 2% max. W	0.125	0.105
*Type 5.	3.5 to 6% Mo, 4.5 to 6% W	0.135	0.115

UNSEGREGATED SOLIDS	UNSEGREGATED TURNINGS
$1.50 per lb. contained W if 5% or more.	$1.30 per lb. contained W if 5% or more.
$1.15 per lb. contained W if 1 to 5%.	$1.00 per lb. contained W if 1 to 5%.
$0.80 per lb. contained Mo if 1.5% or more.	$0.70 per lb. contained Mo if 1.5% or more.

If both W and Mo are within ranges, payment may be for both W and Mo content.

*Per lb. of scrap material.

If segregated, a premium of $1.50 per lb. of contained Co allowed if Co content is 3% or over. No scrap considered segregated if Co content ranges between 0.5 and 3%.

If Cu or Ni content over 0.25%, price shall be reduced by 50%.

If 500 lb. or less is sold, either segregated or unsegregated, price shall be reduced 2c. per lb. of scrap material.

Cast Iron Scrap

Maximum on-line price, per gross ton, for any of the following cast grades will be the price shown at the highest priced zone in which the railroad operates or is located.

	Per Gross Ton		
	Zone A	Zone B	Zone C
Cast Iron, No. 1	$18.00	$19.00	$20.00
Cast Iron, No. 2	17.00	18.00	19.00
Cast Iron, No. 3	14.50	15.50	16.50
Cast Iron, No. 4	13.25	14.25	15.25
Cast Iron Brake Shoes	13.25	14.25	15.25
Malleable	20.00	21.00	22.00
Wheels, No. 1	18.00	19.00	20.00

Zone A includes Mont., Idaho, Wyo., Nev., Utah, Ariz., and N. M. Zone B includes N. D., S. D., Neb., Colo., Kan., Okla., Texas, and Fla. Zone C includes all states not named in zones A and B, and includes switching district of Kansas City, Kansas-Missouri.

For cast, an in-transit preparation fee will be applicable only for preparing Cast ron No. 3 into Cast Iron No. 1, for which the maximum preparation fee shall be $3.50 per gross ton. (Previous dealer fee was $2.50.)

CAST IRON GRADE DEFINITIONS: Cast Iron No. 1—Cast Iron scrap such as columns, pipe, plates and/or castings of miscellaneous nature, but free from stove plate, brake shoes, and/or burnt scrap. Must be cupola size not over 24 x 30 in. and no pieces to weigh more than 150 lb. Free of foreign material. No. 2—Cast iron scrap in pieces weighing over 150 lb. not more than 500 lb. and free from burnt cast. No. 3—Cast iron scrap in pieces over 500 lb., includes cylinders, driving wheel centers, and/or all other castings. Free from hammer blocks or bases. No. 4—Burnt cast iron scrap such as grate bars, stove parts, and/or miscellaneous burnt scrap. No. 5—Driving and/or car brake shoes of all types except composition filled. Malleable—Malleable parts of automobiles, railroad cars, and locomotives. No. 7—Wheels, No. 1, includes cast iron car and/or locomotive wheels.

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Signal Corps Photo

● This beating the Nazis to their knees hurts. From every mission scores of bombers and fighters struggle home shot up so badly you'd never think they'd fly again.

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Comparison of Prices . . .

Advances Over Past Week in Heavy Type; Declines in *Italics*. [Prices Are F.O.B. Major Basing Points]

Flat Rolled Steel: (Cents Per Lb.)	May 16, 1944	May 9, 1944	April 11, 1944	May 18, 1943
Hot rolled sheets	2.10	2.10	2.10	2.10
Cold rolled sheets	3.05	3.05	3.05	3.05
Galvanized sheets (24 ga.)	3.50	3.50	3.50	3.50
Hot rolled strip	2.10	2.10	2.10	2.10
Cold rolled strip	2.80	2.80	2.80	2.80
Plates	2.10	2.10	2.10	2.10
Plates, wrought iron	3.80	3.80	3.80	3.80
Stain's c.r. strip (No. 302)	28.00	28.00	28.00	28.00
Tin and Terne Plate: (Dollars Per Base Box)				
Tin plate, standard cokes	$5.00	$5.00	$5.00	$5.00
Tin plate, electrolytic	4.50	4.50	4.50	4.50
Special coated mfg. ternes	4.30	4.30	4.30	4.30
Bars and Shapes: (Cents Per Lb.)				
Merchant bars	2.15	2.15	2.15	2.15
Cold finished bars	2.65	2.65	2.65	2.65
Alloy bars	2.70	2.70	2.70	2.70
Structural shapes	2.10	2.10	2.10	2.10
Stainless bars (No. 302)	24.00	24.00	24.00	24.00
Wrought iron bars	4.40	4.40	4.40	4.40
Wire and Wire Products: (Cents Per Lb.)				
Plain wire	2.60	2.60	2.60	2.60
Wire nails	2.55	2.55	2.55	2.55
Rails: (Dollars Per Gross Ton)				
Heavy rails	$40.00	$40.00	$40.00	$40.00
Light rails	40.00	40.00	40.00	40.00
Semi-Finished Steel: (Dollars Per Gross Ton)				
Rerolling billets	$34.00	$34.00	$34.00	$34.00
Sheet bars	34.00	34.00	34.00	34.00
Slabs, rerolling	34.00	34.00	34.00	34.00
Forging billets	40.00	40.00	40.00	40.00
Alloy blooms, billets, slabs	54.00	54.00	54.00	54.00
Wire Rods and Skelp: (Cents Per Lb.)				
Wire rods	2.00	2.00	2.00	2.00
Skelp	1.90	1.90	1.90	1.90

Pig Iron: (Per Gross Ton)	May 16, 1944	May 9, 1944	April 11, 1944	May 18, 1943
No. 2 fdy., Philadelphia	$25.84	$25.84	$25.84	$25.89
No. 2, Valley furnace	24.00	24.00	24.00	24.00
No. 2, Southern Cin'ti	25.11	25.11	25.11	24.68
No. 2, Birmingham	20.38	20.38	20.38	20.38
No. 2, foundry, Chicago†	24.00	24.00	24.00	24.00
Basic, del'd eastern Pa.	25.34	25.34	25.34	25.39
Basic, Valley furnace	23.50	23.50	23.50	23.50
Malleable, Chicago†	24.00	24.00	24.00	24.00
Malleable, Valley	24.00	24.00	24.00	24.00
L. S. charcoal, Chicago	37.34	37.34	37.34	31.34
Ferromanganese‡	135.00	135.00	135.00	135.00

†The switching charge for delivery to foundries in the Chicago district is 60c. per ton.
‡For carlots at seaboard.

Scrap: (Per Gross Ton)				
Heavy melt'g steel, P'gh.	$20.00	$20.00	$20.00	$20.00
Heavy melt'g steel, Phila.	18.75	18.75	18.75	18.75
Heavy melt'g steel, Ch'go	18.75	18.75	18.75	18.75
No. 1 hy. comp. sheet, Det.	17.85	17.85	17.85	17.85
Low phos. plate, Youngs'n	22.50	22.50	22.50	22.50
No. 1 cast, Pittsburgh	20.00	20.00	20.00	20.00
No. 1 cast, Philadelphia	20.00	20.00	20.00	20.00
No. 1 cast, Ch'go	20.00	20.00	20.00	20.00
Coke, Connellsville: (Per Net Ton at Oven)				
Furnace coke, prompt	$7.00	$7.00	$7.00	$6.50
Foundry coke, prompt	8.25	8.25	8.25	7.50
Non-Ferrous Metals: (Cents per Lb. to Large Buyers)				
Copper, electro., Conn.	12.00	12.00	12.00	12.00
Copper, Lake	12.00	12.00	12.00	12.00
Tin (Straits), New York	52.00	52.00	52.00	52.00
Zinc, East St. Louis	8.25	8.25	8.25	8.25
Lead, St. Louis	6.35	6.35	6.35	6.35
Aluminum, Virgin, del'd.	15.00	15.00	15.00	15.00
Nickel, electrolytic	35.00	35.00	35.00	35.00
Magnesium, ingot	20.50	20.50	20.50	20.50
Antimony (Asiatic), N. Y.	16.50	16.50	16.50	16.50

The various basing points for finished and semi-finished steel are listed in the detailed price tables, pages 180-189.

Composite Prices . . .

Starting with the issue of April 22, 1943, the weighted finished steel price index was revised for the years 1941, 1942 and 1943. See explanation of the change on page 90 of the April 22, 1943, issue.

	FINISHED STEEL	PIG IRON	SCRAP STEEL
May 16, 1944	2.25513c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One week ago	2.25513c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One month ago	2.25513c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One year ago	2.26190c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton

	HIGH	LOW	HIGH	LOW	HIGH	LOW
1943	2.25513c.,	2.25513c.,	$23.61	$23.61	$19.17	$19.17
1942	2.26190c.,	2.26190c.,	23.61	23.61	19.17	19.17
1941	2.43078c.,	2.43078c.,	$23.61, Mar. 20	$23.45, Jan. 2	$22.00, Jan. 7	$19.17, Apr. 10
1940	2.30467c., Jan. 2	2.24107c., Apr. 16	23.45, Dec. 23	22.61, Jan. 2	21.83, Dec. 30	16.04, Apr. 9
1939	2.35367c., Jan. 3	2.26689c., May 16	22.61, Sept. 19	20.61, Sept. 12	22.50, Oct. 3	14.08, May 16
1938	2.58414c., Jan. 4	2.27207c., Oct. 18	23.25, June 21	19.61, July 6	15.00, Nov. 22	11.00, June 7
1937	2.58414c., Mar. 9	2.32263c., Jan. 4	23.25, Mar. 9	20.25, Feb. 16	21.92, Mar. 30	12.67, June 8
1936	2.32263c., Dec. 28	2.05200c., Mar. 10	19.74, Nov. 24	18.73, Aug. 11	17.75, Dec. 21	12.67, June 9
1935	2.07642c., Oct. 1	2.06492c., Jan. 8	18.84, Nov. 5	17.83, May 14	13.42, Dec. 10	10.33, Apr. 29
1934	2.15367c., Apr. 24	1.95757c., Jan. 2	17.90, May 1	16.90, Jan. 27	13.00, Mar. 13	9.50, Sept. 25
1933	1.95578c., Oct. 3	1.75836c., May 2	16.90, Dec. 5	13.56, Jan. 3	12.25, Aug. 8	6.75, Jan. 3
1932	1.89196c., July 5	1.83901c., Mar. 1	14.81, Jan. 5	13.56, Dec. 6	8.50, Jan. 12	6.43, July 5
1931	1.99626c., Jan. 13	1.86586c., Dec. 29	15.90, Jan. 6	14.79, Dec. 15	11.33, Jan. 6	8.50, Dec. 29
1930	2.25488c., Jan. 7	1.97319c., Dec. 9	18.21, Jan. 7	15.90, Dec. 16	15.00, Feb. 18	11.25, Dec. 9
1929	2.31773c., May 28	2.26498c., Oct. 29	18.71, May 14	18.21, Dec. 17	17.58, Jan. 29	14.08, Dec. 3

Weighted index based on steel bars, beams, tank plates, wire, rails, black pipe, hot and cold-rolled sheets and strip, representing 78 per cent of the United States output. Index recapitulated in Aug. 28, 1941, issue.

Based on averages for basic iron at Valley furnaces and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Southern iron at Cincinnati.

Based on No. 1 heavy melting steel scrap quotations to consumers at Pittsburgh, Philadelphia and Chicago.

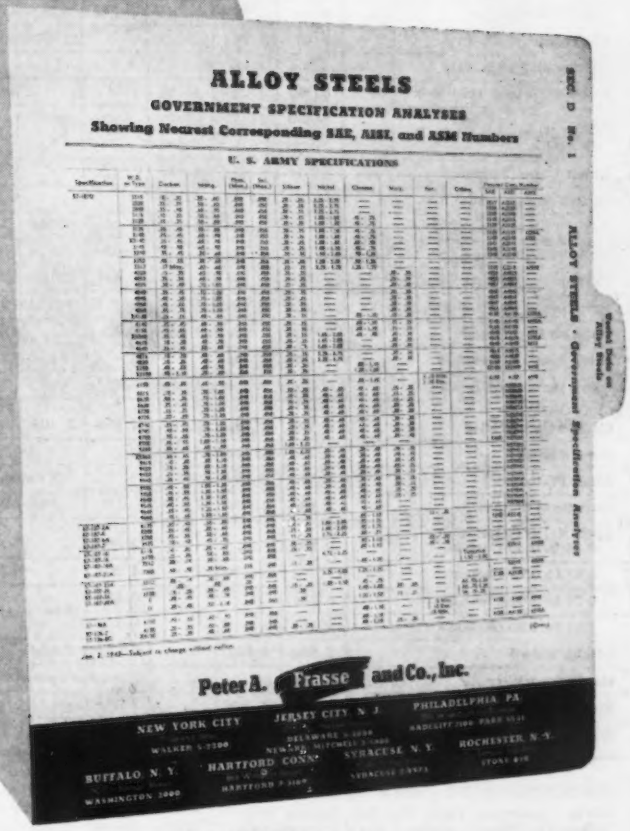
New GOVERNMENT "SPECS" FOR ALLOY STEELS

Revised Frasse Data Chart Now Available

INCORPORATING all recent corrections and additions, this new Frasse Data Chart enables you to identify latest Government "specs" for alloy steels at a glance.

It shows the chemical analysis requirements for each Army, Navy, and Federal specification, together with its nearest commercial equivalent in SAE, AISI, and AMS numbers. Government "specs" for NE steels are included

The chart is handy file size, printed on tough stock, and suitable for wall or desk use. If you're working to Government "specs", you'll find it invaluable. Just send in the coupon—a copy will be sent to you by return mail.



Frasse MECHANICAL AND AIRCRAFT STEELS

Peter A. Frasse & Co., Inc.
Grand Street at Sixth Ave.,
New York 13, N. Y.

Please send me a copy of your latest Frasse Data Chart, Section D, No. 1, showing Government "specs" for alloy steels and corresponding commercial designations.

NAME _____

FIRM _____ ADDRESS _____

9

SEAMLESS MECHANICAL AND AIRCRAFT TUBING • COLD FINISHED BARS • DRILL ROD • AIRCRAFT STEELS
STAINLESS STEELS AND TUBING • ALLOY STEELS • COLD ROLLED STRIP AND SHEETS • WELDED STEEL TUBING

Prices of Finished Iron and Steel . . .

Steel prices shown here are f.o.b. basing points, in cents per lb., unless otherwise indicated. Extras apply. Delivered prices do not reflect 3% tax on freight. (1) Mill run sheet, 10c. per lb. under base; primes 25c. above base. (2) Unassorted 8-lb. coating. (3) Widths up to 12-in. (4) 0.25 carbon and less. (5) Applies to certain width and length limitations. (6) For merchant trade. (7) For straight length material only from producer to consumer. Discount of 25c. per 100 lb. to fabricators. (8) Also shafting. For quantities of 20,000 to 29,999 lb. (9) Carload lot in manufacturing trade. (10) Prices do not apply if rail and water is not used. (12) Boxed. (13) Portland and Seattle price, San Francisco 2.50c. (14) This base price to be used in figuring annealed, bright finish wires, commercial spring wire.

Basing Point → / Product ↓	Pittsburgh	Chicago	Gary	Cleveland	Birmingham	Buffalo	Youngstown	Sparrows Point	Granite City	Middletown, Ohio	Gulf Ports, Cars	Pacific Ports, Cars[10]	DELIVERED TO Detroit	New York	Philadelphia
Hot Rolled Sheets	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.20¢	2.10¢		2.65¢	2.20¢	2.34¢	2.27¢
Cold Rolled Sheets[1]	3.05¢	3.05¢	3.05¢	3.05¢		3.05¢	3.05¢		3.15¢	3.05¢		3.70¢	3.15¢	3.39¢	3.37¢
Galvanized Sheets (24 gage)	3.50¢	3.50¢	3.50¢		3.50¢	3.50¢	3.50¢	3.50¢	3.60¢	3.50¢		4.05¢		3.74¢	3.67¢
Enameling Sheets (20 gage)	3.35¢	3.35¢	3.35¢	3.35¢			3.35¢		3.45¢	3.35¢		4.00¢	3.45¢	3.71¢	3.67¢
Long Ternes[2]	3.80¢	3.80¢	3.80¢									4.55¢		4.16¢	4.12¢
Hot Rolled Strip[3]	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢			2.10¢		2.75¢	2.20¢	2.46¢	
Cold Rolled Strip[4]	2.80¢	2.90¢		2.80¢			2.80¢	(Worcester = 3.00¢)					2.90¢	3.16¢	
Cooperage Stock Strip	2.20¢	2.20¢			2.20¢		2.20¢							2.56¢	
Commodity C-R Strip	2.95¢	3.05¢		2.95¢			2.95¢	(Worcester = 3.35¢)					3.05¢	3.31¢	
Coke Tin Plate, Base Box	$5.00	$5.00	$5.00						$5.10					5.36¢	5.32¢
.50 / .75 Electro Tin Plate, Box	$4.50	$4.50	$4.50						$4.60						
	$4.65		$4.65						$4.75						
Black Plate (29 gage)[5]	3.05¢	3.05¢	3.05¢						3.15¢			4.05¢[12]			3.37¢
Mfg. Ternes, Special Box	$4.30	$4.30	$4.30						$4.40						
Carbon Steel Bars	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢		(Duluth = 2.25¢)			2.50¢	2.80¢	2.25¢	2.49¢	2.47¢
Rail Steel Bars[6]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢					2.50¢	2.80¢			
Reinforcing (Billet) Bars[7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢			2.50¢	2.55¢[13]	2.25¢	2.39¢	
Reinforcing (Rail) Bars[7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢				2.50¢	c2.55¢[13]	2.25¢		2.47¢
Cold Finished Bars[8]	2.65¢	2.65¢	2.65¢	2.65¢		2.65¢			(Detroit = 2.70¢)		(Toledo = 2.80¢)			2.99¢	2.97¢
Alloy Bars, Hot Rolled	2.70¢	2.70¢				2.70¢		(Bethlehem, Massillon, Canton = 2.70¢)					2.80¢		
Alloy Bars, Cold Drawn	3.35¢	3.35¢	3.35¢	3.35¢		3.35¢							3.45¢		
Carbon Steel Plates	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢	(Coatesville and Claymont = 2.10¢) 2.10¢	2.35¢		2.45¢	2.65¢	2.32¢	2.29¢	2.15¢
Floor Plates	3.35¢	3.35¢									3.70¢	4.00¢		3.71¢	3.67¢
Alloy Plates	3.50¢	3.50¢			(Coatesville = 3.50¢)						3.95¢	4.15¢		3.70¢	3.59¢
Structural Shapes	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢		(Bethlehem = 2.10¢)			2.45¢	2.75¢		2.27¢	2.215¢
SPRING STEEL, C-R 0.26 to 0.50 Carbon	2.80¢			2.80¢			(Worcester = 3.00¢)								
0.51 to 0.75 Carbon	4.30¢			4.30¢			(Worcester = 4.50¢)								
0.76 to 1.00 Carbon	6.15¢			6.15¢			(Worcester = 6.35¢)								
1.01 to 1.25 Carbon	8.35¢			8.35¢			(Worcester = 8.55¢)								
Bright Wire[14]	2.60¢	2.60¢		2.60¢	2.60¢		(Worcester = 2.70¢)		(Duluth = 2.65¢)			3.10¢			2.92¢
Galvanized Wire	Add proper size extra and galvanizing extra to Bright Wire base.														
Spring (High Carbon)	3.20¢	3.20¢		3.20¢			(Worcester = 3.30¢)					3.70¢			3.52¢
Steel Sheet Piling	2.40¢	2.40¢				2.40¢						2.95¢			2.72¢

EXCEPTIONS TO PRICE SCHED. NO. 6

Slabs—Andrews Steel Co. $41 basing pts.; Wheeling Steel Corp. $34 Portsmouth, Ohio; Empire Sheet & Tin Plate Corp. $41; Phoenix Iron Co. (rerolling) $41, (forging) $47; Granite City Steel Co. $47.50.

Blooms—Phoenix Iron Co. (rerolling) $41, (forging) $47.

Sheet Bar—Empire Sheet & Tin Plate Co. $39 mill; Wheeling Steel Corp. $38 Portsmouth, Ohio.

Billets, Forging—Andrews Steel Co. $50 basing pts.; Follansbee Steel Corp. $49.50 Toronto; Phoenix Iron Co. $47.00 mill.

Billets, Rerolling—Continental Steel Corp. may charge Acme Steel in Chicago switching area $34 plus freight from Kokomo, Ind.; Northwestern Steel & Wire Co. (Lend-Lease) $41 mill; Wheeling Steel Corp. (small) $36 Portsmouth, Ohio; (blooming mill sizes) applicable base, f.o.b. Portsmouth, Ohio; Stanley Works may sell Washburn Wire Co. under allocation at $39 Bridgeport, Conn.; Keystone Steel & Wire Co. may sell Acme Steel Co. at Chicago base, f.o.b. Peoria; Phoenix Iron Co. $41 mill; Continental Steel Corp. (1¾ x 1¾) $39.50, (2 x 2) $40.60 Kokomo, Ind. (these prices include $1 size extra); Keystone Steel & Wire Co. $36.40 Peoria; Connors Steel Co. $50.69 Birmingham; Ford Motor Co. $34 Dearborn, Mich.

Structural Shapes—Phoenix Iron Co. $2.35 basing pts., (export) $2.50 Phoenixville; Knoxville Iron Co. $2.30 basing pts.

Bar Size Shapes—(Angles) W. Ames & Co., 10 tons or over, $3.10 mill.

Rails—Sweet Steel Co. (rail steel) $50 mill; West Virginia Rail Co. (lightweight) on allocation based Huntington, W. Va.; Colorado Fuel & Iron Corp. $45 Pueblo.

Hot Rolled Plate—Granite City Steel Co. $2.65 mill; Knoxville Iron Co. $2.25 basing pts.; Kaiser Co. $3.20 Pacific Ports; Central Iron & Steel Co. $2.50 basing points; Granite City Steel Co. $2.35 Granite City.

Merchant Bars—W. Ames & Co., 10 tons and over, $2.85 mill; Eckels-Nye Steel Corp., $2.50 basing pts. (rail steel) $2.40; Phoenix Iron Co. $2.40 basing pts.; Sweet Steel Co. (rail steel) $2.35 mill; Joslyn Mfg. & Supply Co. $2.35 Chicago; Calumet Steel Div., Borg Warner Corp. (8 in. mill bars) $2.35 Chicago; Knoxville Iron Co. $2.30 basing pts. Laclede Steel Co., sales to LaSalle Steel granted Chicago base, f.o.b. Madison, Ill.

Reinforcing Bars—W. Ames & Co., 10 tons and over, $2.85 mill; Sweet Steel Co. (rail steel) $2.35 mill; Columbia Steel Co. $2.50 Pacific Ports.

Cold Finished Bars—Keystone Drawn Steel Co. on allocation, Pittsburgh c.f. base plus c/l freight on hot rolled bars Pittsburgh to Spring City, Pa.; New England Drawn Steel Co. on allocation outside New England, Buffalo c.f. base plus c/l freight Buffalo to Massfield, Mass., f.o.b. Massfield.; Empire Finished Steel Corp. on allocation outside New England, Buffalo c.f. base plus c/l freight Buffalo to plants f.o.b. plant; Compressed Steel Shafting Co. on allocation outside New England, Buffalo base plus c/l freight Buffalo to Readville, Mass. f.o.b. Readville; Medart Co. in certain areas, Chicago c.f. base plus c/l freight Chicago to St. Louis, f.o.b. St. Louis.

Alloy Bars—Texas Steel Co. for delivery except Texas and Okla. Chicago base, f.o.b. Fort Worth, Tex.; Connors Steel Co. shipped outside Ala., Mississippi, Louisiana, Georgia, Florida, Tenn., Pittsburgh base, f.o.b. Birmingham.

Hot Rolled Strip—Joslyn Mfg. & Supply Co. $2.30 Chicago; Knoxville Iron Co. $2.25 basing pts.

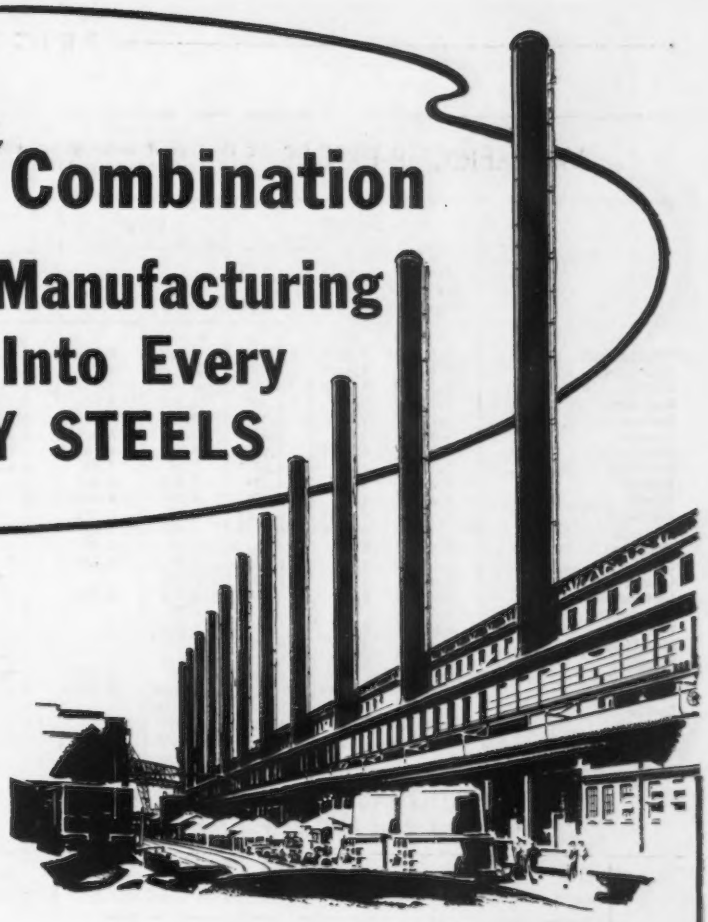
Hot Rolled Sheets—Andrews Steel Co., Middletown base on shipments to Detroit or area; Parkersburg Iron & Steel Co., $2.25 Parkersburg.

Galvanized Sheets—Andrews Steel Co., $3.75 basing pts.; Parkersburg Iron & Steel Co. $3.85 Parkersburg; Apollo Steel Co. $3.75 basing pts.; Continental Steel Co., Middletown base on Kokomo, Ind., product; Superior Sheet Steel Co., Pittsburgh base except for Lend-Lease.

Pipe and Tubing—South Chester Tube Co. when priced at Pittsburgh, freight to Gulf Coast and Pacific Ports may be charged from Chester, Pa., also to points lying west of Harrisburg, Pa.

Black Sheets—Empire Sheet and Tinplate Co., maximum base price mill is $2.45 per 100 lb., with differentials, transportation charges, etc., provided in RPS. No. 6.

The *Right* Combination of Materials and Manufacturing "Know-How" Goes Into Every Ton of Our ALLOY STEELS



THE *right* combination of materials and manufacturing "know-how" goes into *every* ton of Wisconsin Alloy Steels, with skilled manpower supervising every operation.

Other factors, too, are important in our steel production. A thorough knowledge of customer requirements is one. Unified control of all operations, from mines to finished product, is another. A series of scrutinizing checks and double-checks, from the time the order is placed until the shipment is on its way to the customer, is another.

This follow-through makes Wisconsin Alloy Steels a QUALITY product . . . your assurance of user satisfaction.

WISCONSIN STEEL PRODUCTS

Open Hearth Alloy and Carbon Steel

Rounds, Flats, Squares, Bands, Skelp, Screw Steel

Agricultural and Special Shapes

Structural Angles, Beams, and Channels

Universal Plates

Cold Drawn and Turned Shafting

Pig Iron: Malleable, Foundry, Bessemer, and Basic

WISCONSIN STEEL COMPANY

AFFILIATE OF INTERNATIONAL HARVESTER COMPANY

General Offices: 180 North Michigan Avenue **Chicago 1, Illinois**

WAREHOUSE PRICES

Delivered metropolitan areas per 100 lb. These are zoned warehouse prices in conformance with latest zoning amendments to OPA Price Schedule 49.

Cities	SHEETS			STRIP		Plates ¼ in. and heavier	Structural Shapes	BARS		ALLOY BARS			
	Hot Rolled (10 gage)	Cold Rolled	Galvanized (24 gage)	Hot Rolled	Cold Rolled			Hot Rolled	Cold Finished	Hot Rolled, NE 8617-20	Hot Rolled, NE 9442-45 Ann.	Cold Drawn, NE 8617-20	Cold Drawn, NE 9442-48 Ann.
**Philadelphia	3.518	4.872[8]	5.018[a]	3.922	4.772	3.605	3.666	3.822	4.072	5.966	7.066	7.272	8.322
New York	3.590	4.613[3]	5.010	3.974[6]	4.772	3.768	3.758	3.853	4.103	6.008	7.108	7.303	8.353
Boston	3.744	4.744[9]	5.224[9]	4.106	4.715	3.912	3.912	4.044	4.144	6.162	7.262	7.344	8.394
Baltimore	3.394	4.852	4.894	3.902	4.752	3.594	3.759	3.802	4.052	....	....	....	....
Norfolk	3.771	4.965	5.371	4.165	4.865	3.971	4.002	4.065	4.165	....	....	....	....
Chicago	3.25	4.20	5.231	3.60	4.65[17]	3.55	3.55	3.50	3.75	5.75	6.85	6.85	7.90
Milwaukee	3.387	4.337[3]	5.272[4]	3.737	4.787[17]	3.687	3.687	3.637	3.887	5.987	7.087	7.087	8.137
Cleveland	3.35	4.40	4.877[4]	3.60	4.45	3.40	3.588	3.35	3.75	5.956	7.056	6.85	7.90
Buffalo	3.35	4.40	4.754	3.819	4.669	3.63	3.40	3.35	3.75	5.75	6.85	6.85	7.90
Detroit	3.45	4.50	5.004	3.70	4.659[17]	3.609	3.661	3.45	3.80	6.08	7.18	7.159	8.209
Cincinnati	3.425	4.475[3]	4.825[5]	3.675	4.711	3.611	3.691	3.611	4.011	....	....	....	....
St. Louis	3.397	4.347[3]	5.172[4]	3.747	4.931[17]	3.697	3.697	3.647	4.031	6.131	7.231	7.231	8.281
Pittsburgh	3.35	4.40	4.75	3.60	4.45	3.40	3.40	3.35	3.75	5.75	6.85	6.85	7.90
St. Paul	3.51	4.48	5.257[4]	3.86	4.35[17]	3.81[13]	3.81[13]	3.78[13]	4.361	6.09	7.19	7.561	8.711
Omaha	3.865	5.443	5.608[4]	4.215	....	4.165	4.165	4.115	4.43	....	....	....	....
Indianapolis	3.58	3.58	4.568	4.918	3.768	4.78	3.63	3.58	3.98	6.08	7.18	7.18	8.23
Birmingham	3.45	....	4.75	3.70	....	3.55	3.55	3.50	4.43	....	....	....	....
Memphis	3.965[7]	4.66	3.265	4.215	....	4.065	4.065	4.015	4.33	....	....	....	....
New Orleans	4.058*	4.95	5.358	4.308	....	4.158	4.158*	4.108*	4.629	....	....	....	....
Houston	3.763	5.573	6.313[1]	4.313	....	4.25	4.25	3.75	6.373[3]	7.223	8.323	8.323	9.373
Los Angeles	5.00	7.203	8.104	4.95	5.613[15]	4.95	4.65	4.40	5.583	8.304	9.404	9.404	10.454
San Francisco	4.55[14]	7.304	6.354	4.50[14]	7.333[17]	4.65[14]	4.35[14]	4.15[14]	5.333	8.304	9.404	9.404	10.454
Seattle	4.65[12]	7.054	5.954	4.25[12]	....	4.75[12]	4.45[12]	4.35[12]	5.783	....	9.404	....	....
Portland	4.65[11]	6.604	5.754	4.75[11]	....	4.75[11]	4.45[11]	4.45[11]	5.533	8.304	9.404	8.304	9.404
Salt Lake City	4.53[17]	....	6.17[18]	5.53[17]	....	4.98[17]	4.98[17]	4.88[17]	5.90	....	....	....	....

NATIONAL EMERGENCY (N. E.) STEELS

(Hot Rolled Mill Extras for Alloy Content)

Designation	CHEMICAL COMPOSITION LIMITS, PER CENT								Basic Open-Hearth		Electric Furnace	
	Carbon	Manganese	Phosphorus Max.	Sulphur Max.	Silicon	Chromium	Nickel	Molybdenum	Bars and Bar-Strip	Billets, Blooms and Slabs	Bars and Bar-Strip	Billets, Blooms and Slabs
NE 1330	.28/ .33	1.60/1.90	.040	.040	.20/ .35				.10c	$2.00		
NE 1335	.33/ .38	1.60/1.90	.040	.040	.20/ .35				.10	2.00		
NE 1340	.38/ .43	1.60/1.90	.040	.040	.20/ .35				.10	2.00		
NE 1345	.43/ .48	1.60/1.90	.040	.040	.20/ .35				.10	2.00		
NE 1350	.48/ .53	1.60/1.90	.040	.040	.20/ .35				.10	2.00		
NE 8613	.12/ .17	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25c	$25.00
NE 8615	.13/ .18	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8617	.15/ .20	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8620	.18/ .23	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8630	.28/ .33	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8635	.33/ .38	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8637	.35/ .40	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8640	.38/ .43	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8642	.40/ .45	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8645	.43/ .48	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8650	.48/ .53	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8720	.18/ .23	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.20/ .30	.80	16.00	1.30	26.00
NE 9255	.50/ .60	.70/ .95	.040	.040	1.80/2.20				.40	8.00		
NE 9260	.58/ .65	.70/1.00	.040	.040	1.80/2.20				.40	8.00		
NE 9261	.55/ .65	.70/1.00	.040	.040	1.80/2.20	.10/ .25			.65	13.00		
NE 9262	.55/ .65	.70/1.00	.040	.040	1.80/2.20	.25/ .40			.65	13.00		
NE 9415	.13/ .18	.80/1.10	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9420	.18/ .23	.80/1.10	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9422	.20/ .25	.80/1.10	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9425	.23/ .28	.80/1.10	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9430	.28/ .33	.90/1.20	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9435	.33/ .38	.90/1.20	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9437	.35/ .40	.90/1.20	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9440	.38/ .43	.90/1.20	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9442	.40/ .45	1.00/1.30	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.80	16.00	1.30	26.00
NE 9445	.43/ .48	1.00/1.30	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.80	16.00	1.30	26.00
NE 9450	.48/ .53	1.20/1.50	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.80	16.00	1.30	26.00
NE 9537*	.35/ .40	1.20/1.50	.040	.040	.40/ .60	.40/ .60	.40/ .70	.15/ .25	1.20	24.00	1.70	34.00
NE 9540*	.38/ .43	1.20/1.50	.040	.040	.40/ .60	.40/ .60	.40/ .70	.15/ .25	1.20	24.00	1.70	34.00
NE 9542*	.40/ .45	1.20/1.50	.040	.040	.40/ .60	.40/ .60	.40/ .70	.15/ .25	1.20	24.00	1.70	34.00
NE 9545*	.43/ .48	1.20/1.50	.040	.040	.40/ .60	.40/ .60	.40/ .70	.15/ .25	1.20	24.00	1.70	34.00
NE 9550*	.48/ .53	1.20/1.50	.040	.040	.40/ .60	.40/ .60	.40/ .70	.15/ .25	1.20	24.00	1.70	34.00

*Recommended for large sections only. Note: The extras shown are in addition to a base price of 2.70c. per 100 lb., on finished products and $54 per gross ton on semi-finished steel major basing points and are in cents per 100 lb. and dollars per gross ton in semi-finished. When acid open-hearth is specified and acceptable add to basic open hearth alloy differential 0.25c. per lb. for bars and bar strip, $5.00 per gross ton for billets, blooms and slabs. The ranges shown above are restricted to sizes 100 sq. in. or less or equivalent cross sectional area 18 in. wide or under with a max. individual piece weight of 7000 lb.

Base Quantities

Standard unless otherwise keyed on prices.

HOT ROLLED: Sheets, strip, plates, shapes and bars, 400 to 1999 lb.

COLD ROLLED: Sheets, 400 to 1499 lb.; strip, extras on all quantities; bars, 1500 lb. base; NE alloy bars, 1000 to 39,999 lb.

EXCEPTIONS: (1) 150 to 499 lb. (2) 150 to 1499 lb. (3) 400 to 1499 lb. (4) 450 to 1499 lb. (5) 500 to 1499 lb. (6) 0 to 1999 lb. (7) 400 to 1999 lb. (8) 1000 to 1999 lb. (9) 450 to 3749 lb. (10) 400 to 3999 lb. (11) 300 to 4999 lb. (12) 300 to 10,000 lb. (13) 400 to 14,999 lb. (14) 400 lb. and over. (15) 1000 lb. and over. (16) 1500 lb. and over. (17) 2000 lb. and over. (18) 3500 lb. and over.

(a) Philadelphia: Galvanized sheets, 25 or more bundles.

Extra for size, quality, etc., apply on above quotations.

*Add 0.271c. for sizes not rolled in Birmingham.

**City of Philadelphia only. Applicable freight rates must be added to basing point prices to obtain delivered price to other localities in metropolitan area.

LAKE SUPERIOR ORES

(51.50% *Fe, Natural Content, Delivered Lower Lake Ports**)

	Per Gross Ton
Old range, bessemer, 51.50	$4.75
Old range, non-bessemer, 51.50	4.60
Mesaba, bessemer, 51.50	4.60
Mesaba, non-bessemer, 51.50	4.45
High phosphorus, 51.50	4.35

*Adjustments are made to indicate prices based on variance of Fe content of ores as analyzed on a dry basis by independent laboratories.

FLUORSPAR

Maximum price f.o.b. consumer's plant, $30 per short ton plus either (1) rail freight from producer to consumer, or (2) rail freight from Rosiclare, Ill., to consumer, whichever is lower.

Exception

When the WPB Steel Division certifies in writing the consumer's need for one of the higher grades of metallurgical fluorspar specified in the table below the price shall be taken from the table plus items (1 and 2) from paragraph above.

Effective CaF_2 Content:	*Base price per short ton*
70% or more	$33.00
65% but less than 70%	32.00
60% but less than 65%	31.00
Less than 60%	30.00

PRICES

SEMI-FINISHED STEEL

Ingots, Carbon, Rerolling

Base per gross ton, f.o.b. mill.... $31.00
Exceptions: Phoenix Iron Co. may charge $38.75; Kaiser Co., $43.00 f.o.b. Pacific Coast Ports; Empire Sheet & Tinplate Co., $34.25.

Ingots, Carbon, Forging

Base per gross ton, f.o.b. Birmingham, Buffalo, Chicago, Cleveland, Gary, Pittsburgh, Youngstown $36.00
Exceptions: Phoenix Iron Co. may charge $43.00; Empire Sheet & Tinplate Co., $39.25, f.o.b. Mansfield, Ohio; West Coast producers, $48.00, f.o.b. Pacific Coast Ports.

Ingots, Alloy

Base per gross ton, f.o.b. Bethlehem, Buffalo, Canton, Coatesville, Chicago, Massillon, Pittsburgh $45.00
Exceptions: C/L delivered Detroit add $2.00; delivered East Michigan add $3.00. Connors Steel Co. may charge $45.00 f.o.b. Birmingham.

Billets, Blooms and Slabs

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham, Sparrows Point (rerolling only). Prices delivered Detroit are $2.00 higher; delivered E. Michigan, $3 higher; f.o.b. Duluth, billets only, $2.00 higher; billets f.o.b. Pacific ports are $12 higher. Delivered prices do not reflect three per cent tax on freight rates.

	Per Gross Ton
Rerolling	$34.00
Forging quality	40.00

For exceptions on semi-finished steel see the footnote on the page of finished steel prices.

Alloy Billets, Blooms, Slabs

Pittsburgh, Chicago, Canton, Massillon, Buffalo, or Bethlehem, per gross ton 54.00
Price delivered Detroit $2.00 higher; E. Michigan $3.00 higher.

Shell Steel

	Per Gross Ton
8 in. to 12 in.	$52.00
12 in. to 18 in.	54.00
18 in. and over	56.00

Basic open hearth shell steel, f.o.b. Pittsburgh, Chicago, Buffalo, Gary, Cleveland, Youngstown and Birmingham.
Prices delivered Detroit are $2.00 higher; E. Michigan, $3 higher.
Note: The above base prices apply on lots of 1000 tons of a size and section to which are to be added extras for chemical requirements, cutting, or quantity.

Sheet Bars

Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point.

	Per Gross Ton
Open hearth or bessemer	$34.00

Skelp

Pittsburgh, Chicago, Youngstown, Coatesville, Pa., Sparrows Point, Md.

	Per Lb.
Grooved, universal and sheared	1.90c.

Wire Rods

(*No. 5 to 9/32 in.*)

	Per Lb.
Pittsburgh, Chicago, Cleveland	2.00c.
Worcester, Mass.	2.10c.
Birmingham	2.00c.
San Francisco	2.50c.
Galveston	2.25c.

9/32 in. to 47/64 in., 0.15c. a lb. higher. Quantity extras apply.

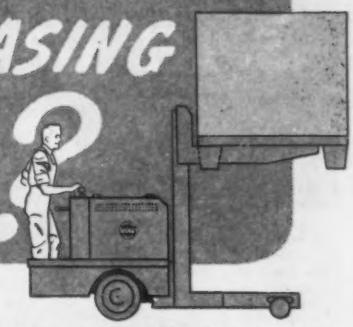
TOOL STEEL

(*F.o.b. Pittsburgh, Bethlehem, Syracuse*)

	Base per lb.
High speed	67c.
Straight molybdenum	54c.
Tungsten-molybdenum	57½c.
High-carbon-chromium	43c.
Oil hardening	24c.
Special carbon	22c.
Extra carbon	18c.
Regular carbon	14c.

Warehouse prices east of Mississippi are 2c. a lb. higher; west of Mississippi 3c. higher.

Is Your Problem One Of Increasing Production?



If so, a Baker Material Handling Engineer can help you. Our files contain case histories of hundreds of plants which have realized their objective through an improvement in handling operations with Baker Trucks. Many of these are illustrated in the new Baker Catalog. A few typical examples are illustrated below.

★ ★ ★

One manufacturer doubled productive capacity without enlarging his plant by constructing a mezzanine floor, and substituting a Baker Crane Truck for overhead cranes removed. The truck further helped production by speeding assembly and handling operations beyond limits of craneways. *(See illustration, left.)*

An aircraft manufacturer uses a Baker Fork Truck for keeping materials and products on the move. Illustration at right shows the truck lining up crated engines for inspection, after which it loads them into box cars for shipment. Carloading with Baker Trucks can release many men for productive work. *(See illustration, right.)*

With the addition of a motor-driven winch, the Baker Hy-Lift Truck at the left, makes die-changing a simple task enabling one operator to do the work of several in much less time. By reducing idle press time, these trucks increase the productive capacity of plant equipment. The same truck also stores the dies in space-saving racks, and serves as a conventional truck, speeding other handling operations. *(See illustration, left.)*

Baker Crane Trucks spot heavy, bulky parts into position, speeding operations on an assembly line. Crane truck at right is moving an airplane fuselage into position. The same truck also assists in installing engines and propellers, and performs other heavy duty in the plant. *(See illustration, right.)*

A large aluminum manufacturer employs women to operate Baker Fork Trucks handling press forgings and other material. This releases experienced manpower for other productive work. By reducing distance within the plant Baker Trucks make practical use of remote areas. *(See illustration, left.)*

Man and machine time can be conserved by having material at hand when and where needed. Baker Low-Lift Truck keeps machine and operator busy by bringing and removing work—at the same time keeping aisles clear, promoting plant safety. *(See illustration, right.)*

WRITE FOR YOUR COPY

Plant and production managers, traffic managers, superintendents, purchasing agents and any others concerned with material handling will find the new Baker Catalog No. 52 a valuable reference.

BAKER INDUSTRIAL TRUCK DIVISION
of The Baker-Raulang Company
2175 WEST 25th STREET • CLEVELAND, OHIO
In Canada: Railway and Power Engineering Corporation, Ltd.

Baker INDUSTRIAL TRUCKS

WELDISKS
SPEED UP GRINDING JOBS SAFELY

Faster because safer!
Safer because
3-Layer backing
eliminates breakage!

No danger of workers getting hurt grinding with "Weldisks". With 3-layer backing, "Weldisks" just can't break.

1st layer – electric furnace treated aluminum oxide grit – toughest abrasive in commercial use. Means faster cutting.

2nd layer – fibre, specially treated and pressed for double strength and hardness. Keeps "Weldisk" edges from going "flabby" under pressure of fast, heavy work.

3rd layer – heavy drill cloth front and back of fibre. Prevents fibre from cracking when bent during grinding.

All grits from 320 to 16. Write for free trial samples!

Abrasive Products, Inc., 535 Pearl Street, South Braintree, Mass.

Abrasive Products, Inc.

SOUTH BRAINTREE 85 MASSACHUSETTS · MAKERS OF JEWEL COATED ABRASIVES

PRICES

WELDED PIPE AND TUBING

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio, Mills

(F.o.b. Pittsburgh only on wrought pipe)
Base Price—$2.00 per Net Ton

	Black	Galv.
Steel (Butt Weld)		
½ in.	63½	51
¾ in.	66½	55
1 to 3 in.	68½	57½
Wrought Iron (Butt Weld)		
½ in.	24	3½
¾ in.	30	10
1 and 1¼ in.	34	16
1½ in.	38	18½
2 in.	37½	18
Steel (Lap Weld)		
2 in.	61	43½
2½ and 3 in.	64	52½
3½ to 6 in.	66	54½
Wrought Iron (Lap Weld)		
2 in.	30½	12
2½ to 3½ in.	31½	14½
4 in.	33½	18
4½ to 8 in.	32½	17
Steel (Butt, extra strong, plain ends)		
½ in.	61½	50½
¾ in.	65½	54½
1 to 3 in.	67	57
Wrought Iron (Same as Above)		
½ in.	25	6
¾ in.	31	12
1 to 2 in.	38	19½
Steel (Lap, extra strong, plain ends)		
2 in.	59	48½
2½ and 3 in.	63	52½
3½ to 6 in.	66½	56
Wrought Iron (Same as Above)		
2 in.	33½	15½
2½ to 4 in.	39	22½
4½ to 6 in.	37½	21

On butt weld and lap weld steel pipe jobbers are granted a discount of 5%. On less-than-carload shipments prices are determined by adding 25 and 30% and the carload freight rate to the base card.

F.o.b. Gary prices are two points lower discount or $4 a ton higher than Pittsburgh or Lorain on lap weld and one point lower discount, or $2 a ton higher on all butt weld.

CAST IRON WATER PIPE

Per Net Ton

6-in. and larger, del'd Chicago....$54.80
6-in. and larger, del'd New York... 52.20
6-in. and larger, Birmingham 46.00
6-in. and larger f.o.b. cars, San Francisco or Los Angeles 69.40
6-in. and larger f.o.b. cars, Seattle. 71.20

Class "A" and gas pipe, $3 extra; 4-in. pipe is $3 a ton above 6-in. Prices shown are for lots of less than 200 tons. For 200 tons or over, 6-in. and larger are $45 at Birmingham and $53.80 delivered Chicago, $59.40 at San Francisco and Los Angeles, and $70.20 at Seattle. Delivered prices do not reflect new 3 per cent tax on freight rates.

BOILER TUBES

Seamless Steel and Lap Weld Commercial Boiler Tubes and Locomotive Tubes Minimum Wall. Net base prices per 100 ft. f.o.b. Pittsburgh, in carload lots.

	Seamless Cold Drawn	Seamless Hot Rolled	Lap Weld Hot Rolled
2 in. o.d. 13 B.W.G.	15.03	13.04	12.38
2½ in. o.d. 12 B.W.G.	20.21	17.54	16.65
3 in. o.d. 12 B.W.G.	22.48	19.50	18.36
3½ in. o.d. 11 B.W.G.	28.37	24.62	23.18
4 in. o.d. 10 B.W.G.	35.20	30.54	28.60

(Extras for less carload quantities)

40,000 lb. or ft., and over.....Base
30,000 lb. or ft. to 39,999 lb. or ft. 5%
20,000 lb. or ft. to 29,999 lb. or ft. 10%
10,000 lb. or ft. to 19,999 lb. or ft. 20%
5,000 lb. or ft. to 9,999 lb. or ft. 30%
2,000 lb. or ft. to 4,999 lb. or ft. 45%
Under 2,000 lb. or ft..... 65%

PRICES

WIRE PRODUCTS

To the trade, f.o.b. Pittsburgh, Chicago, Cleveland, Birmingham, Duluth

	Basing Points Named	Pacific Coast Basing Points†
	Base per Keg	
Standard wire nails	$2.55	$3.05
Coated nails	2.55	3.05
Cut nails, carloads	3.85	....
	Base per 100 Lb.	
Annealed fence wire	$3.05	$3.55
Annealed galv. fence wire	3.40	3.90
	Base Column	
Woven wire fence*	$0.67	$0.85
Fence posts, carloads	.69	.86
Single loop bale ties	.59	.84
Galvanized barbed wire**	.70	.80
Twisted barbless wire	.70	....

*15½ gage and heavier. **On 80-rod spools in carload quantities.

†Prices subject to switching or transportation charges.

BOLTS, NUTS, RIVETS, SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

Machine and Carriage Bolts:

Base discount less case lots

	Per Cent Off List
⅛ in. & smaller x 6 in. & shorter	65½
9/16 & ⅝ in. x 6 in. & shorter	63½
¾ to 1 in. x 6 in. & shorter	61
1⅛ in. and larger, all lengths	59
All diameters over 6 in. long	59
Lag, all sizes	62
Plow bolts	65

Nuts, Cold Punched or Hot Pressed:

(Hexagon or Square)

⅛ in. and smaller	62
9/16 to 1 in. inclusive	59
1⅛ to 1½ in. inclusive	57
1⅝ in. and larger	56

On above bolts and nuts, excepting plow bolts, additional allowance of 10 per cent for full container quantities. There is an additional 5 per cent allowance for carload shipments.

Semi-Fin. Hexagon Nuts	U.S.S.	S.A.E.
Base discount less keg lots		
7/16 in. and smaller	..	64
⅛ in. and smaller	62	..
⅛ in. through 1 in.	..	60
9/16 in. to 1 in.	59	
1⅛ in. through 1½ in.	57	58
1⅝ in. and larger	56	

In full keg lots, 10 per cent additional discount.

Stove Bolts

	Consumer
Packages, nuts loose	71 and 10
In packages, with nuts attached	71
In bulk	80

On stove bolts freight allowed up to 65c. per 100 lb. based on Cleveland Chicago, New York on lots of 200 lb. or over.

Large Rivets

(½ in. and larger)

	Base per 100 lb.
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	$3.75

Small Rivets

(7/16 in. and smaller)

	Per Cent Off List
F.o.b. Pittsburgh, Cleveland Chicago, Birmingham	65 and 5

Cap and Set Screws

	Consumer Per Cent Off List
Upset full fin. hexagon head cap screws, coarse or fine thread, up to and incl. 1 in. x 6 in.	64
Upset set screws, cup and oval points	71
Milled studs	46
Flat head cap screws, listed sizes	36
Fillister head cap, listed sizes	51

Freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago or New York on lots of 200 lb. or over.

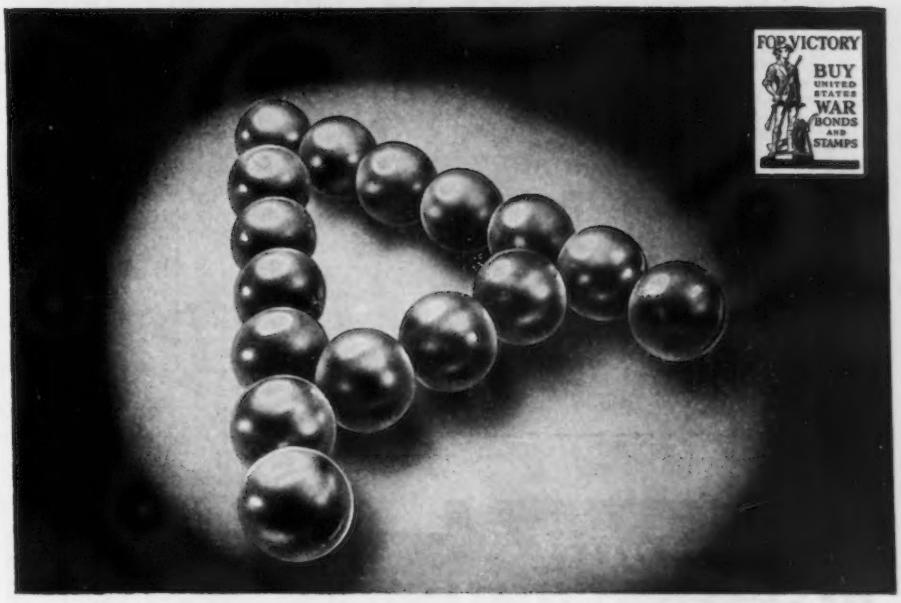
ROOFING TERNE PLATE

(F.o.b. Pittsburgh, 112 Sheets)

	20x14 in.	20x28 in.
8-lb. coating I.C.	$6.00	$12.00
15-lb. coating I.C.	7.00	14.00
30-lb. coating I.C.	7.50	15.00

ROLL ON ABBOTT Bearing BALLS

There's GRUELLING PUNISHMENT in TOMORROW'S PLANS!



YES, every BEARING BALL will be taxed to the limit of its load carrying capacity — must have the stamina to withstand more punishment than ever before. New types of assemblies — more delicate mechanisms will appear—each demanding greater performance, uninterrupted performance from BEARING BALLS.

ABBOTT looks forward with confidence to the plans of tomorrow—plans which will give further proof of the quality, uniform accuracy and uninterrupted performance of ABBOTT BEARING BALLS.

Bring on the jolting shocks—the punishing loads—ABBOTT will "Carry the Load as Planned" now, and tomorrow!

SPECIFY "ABBOTT" for UNINTERRUPTED PERFORMANCE

ROLL ON ABBOTT Bearing BALLS

THE ABBOTT BALL COMPANY HARTFORD, CONN. U.S.A.

PIG IRON

All prices set in bold face type are maxima established by OPA on June 24, 1941. Other domestic prices (in italics) are delivered quotations per gross ton computed on the basis of the official maxima. Delivered prices do not reflect 3 per cent tax on freight rates.

	No. 2 Foundry	Basic	Bessemer	Malleable	Low Phosphorus	Charcoal
Boston	*$25.50*	*$25.00*	*$26.50*	*$26.00*	....	....
Brooklyn	*27.50*	*27.00*	....	*28.00*	....	....
Jersey City	*26.53*	*26.03*	*27.53*	*27.03*	....	....
Philadelphia (4)	*25.84*	*25.34*	*26.84*	*26.34*	*$30.74*	....
Bethlehem, Pa.	25.00	24.50	26.00	25.50	....	....
Everett, Mass.	25.00	24.50	26.00	25.50	....	....
Swedeland, Pa.	25.00	24.50	26.00	25.50	....	....
Steelton, Pa.	....	24.50	....	....	29.50	....
Birdsboro, Pa. (3)	25.00	24.50	26.00	25.50	29.50	....
Sparrows Point, Md.	25.00	24.50	....	....	....	....
Erie, Pa.	24.00	23.50	25.00	24.50	....	....
Neville Island, Pa.	24.00	23.50	24.50	24.00	....	....
Sharpsville, Pa. (1)	24.00	23.50	24.50	24.00	....	....
Buffalo	24.00	23.50	25.00	24.50	29.50	....
Cincinnati, Ohio	*25.11*	*24.61*	....	*25.11*	....	....
Canton, Ohio	*25.39*	*24.89*	*25.89*	*25.39*	*32.69*	....
Mansfield, Ohio	*25.94*	*25.44*	*26.44*	*25.94*	*32.86*	....
St. Louis	*24.50*	*24.50*	....	....	....	....
Chicago	24.00	23.50	24.50	24.00	*35.46*	.... *$37.34*
Granite City, Ill.	24.00	23.50	24.50	24.00	....	....
Cleveland	24.00	23.50	24.50	24.00	*32.42*	....
Hamilton, Ohio	24.00	23.50	....	24.00	....	....
Toledo	24.00	23.50	24.50	24.00	....	....
Youngstown	24.00	23.50	24.50	24.00	*32.42*	....
Detroit	24.00	23.50	24.50	24.00	....	....
Lake Superior fc.	....	....	....	....	....	34.00
Lyles, Tenn. fc. (2)	....	....	....	....	....	33.00
St. Paul	*26.63*	26.13	*27.13*	*26.63*	*39.80*	....
Duluth	24.50	24.00	25.00	24.50	....	....
Birmingham	20.38	19.00	25.00	....	....	....
Los Angeles	*26.95*	....	....	....	....	....
San Francisco	*26.95*	....	....	....	....	....
Seattle	*26.95*	....	....	....	....	....
Provo, Utah	22.00	21.50	....	....	....	....
Montreal	*27.50*	*27.50*	.....	*28.00*	.....	.....
Toronto	*25.50*	*25.50*	.....	*26.00*	.....	.....

GRAY FORGE IRON: Valley or Pittsburgh furnace $23.50

(1) Pittsburgh Coke & Iron Co. (Sharpsville, Pa., furnace only) and the Struthers Iron and Steel Co., Struthers, Ohio, may charge 50c. a ton in excess of basing point prices for No. 2 foundry, basic, bessemer and malleable. Struthers Iron and Steel Co. may add another $1.00 per gross ton for iron from Struthers, Ohio, plant.

(2) Price shown is for low-phosphorous iron; high phosphorous sells for $28.50 at the furnace.

(3) E. & G. Brooke Co. Birdsboro, Pa., permitted to charge $1.00 per ton extra.

(4) Pittsburgh Ferromanganese Co. (Chester furnace only) may charge $2.25 a ton over maximum basing point prices.

Basing point prices are subject to switching charges; Silicon differentials (not to exceed 50c. a ton for each 0.25 per cent silicon content in excess of base grade which is 1.75 to 2.25 per cent); Phosphorus differentials, a reduction of 38c. per ton for phosphorus content of 0.70 per cent and over; Manganese differentials, a charge not to exceed 50c. per ton for each 0.50 per cent manganese content in excess of 1.00 per cent. Effective March 3, 1943, $2 per ton extra may be charged for 0.5 to 0.75 per cent nickel content and $1 per ton extra for each additional 0.25 per cent nickel.

METAL POWDERS

Prices are based on current market prices of ingots plus a fixed figure. F.o.b. shipping point, c. per lb., ton lots.

Copper, electrolytic, 150 and 200 mesh	21⅛ to 23½c.
Copper, reduced, 150 and 200 mesh	20½ to 25½c.
Iron, commercial, 100 and 200 mesh, 96 + % Fe	13½ to 15c.
Iron, crushed, 200 mesh and finer, 90 + % Fe	4c.
Iron, hydrogen reduced, 300 mesh and finer, 98½ + % Fe	63c.
Iron, electrolytic, unannealed, 300 mesh and coarser, 99 + % Fe	30 to 33c.
Iron, electrolytic, annealed minus 100 mesh, 99 + % Fe	42c.
Iron, carbonyl, 300 mesh and finer, 98-99.8 + % Fe	90c.
Aluminum, 100 and 200 mesh	*23 to 27c.
Antimony, 100 mesh	20.6c.
Cadmium, 100 mesh	$1
Chromium, 150 mesh	$1.03
Lead, 100, 200 & 300 mesh, 11½ to 12½c.	
Manganese, 150 mesh	51c.
Nickel, 150 mesh	51½c.
Solder powder, 100 mesh, 8½c. plus metal	
Tin, 100 mesh	58¾c.
Tungsten metal powder, 98%-99%, any quantity, per lb.	$2.60
Molybdenum power, 99%, in 200-lb. kegs, f.o.b. York, Pa., per lb.	$2.60
Under 100 lb.	$3.00

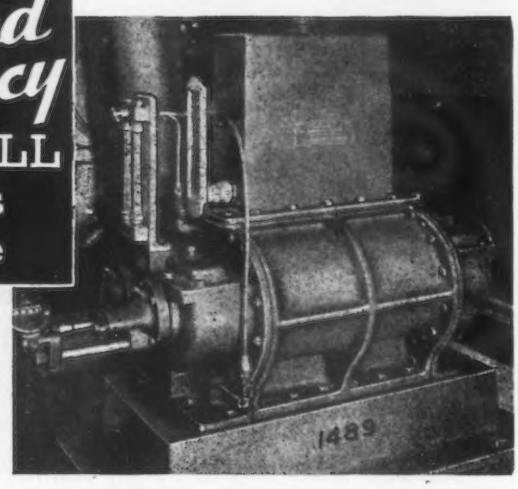
*Freight allowed east of Mississippi.

COKE

Furnace, beehive (f.o.b. oven)	Net Ton
Connellsville, Pa.	$7.00*
Foundry, beehive (f.o.b. oven)	
Fayette Co., W. Va.	8.10
Connellsville, Pa.	8.25
Foundry, By-Product	
Chicago, del'd	13.35
Chicago, f.o.b.	12.60
New England, del'd	14.25
Kearny, N. J., f.o.b.	12.65
Philadelphia, del'd	12.88
Buffalo, del'd	13.00
Portsmouth, Ohio, f.o.b.	11.10
Painesville, Ohio, f.o.b.	11.75
Erie, del'd	12.75
Cleveland, del'd	12.80
Cincinnati, del'd	12.85
St. Louis, del'd	13.85
Birmingham, del'd	10.50

*Hand drawn ovens using trucked coal permitted to charge $7.75 per ton plus transportation charges. **Mo., Ala., and Tenn. producers—$13.35.

Maintained accuracy ... on SMALL volumes as well as large



SPEED YOUR WAR PRODUCTION

If you need these meter units to help maintain or increase vital war production — write us today for information.

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PRODUCE, SHARE, and PLAY SQUARE WITH FOOD!

3,000 Cu. Ft. Hr. and Up

"R-C" Rotary Positive Meters, for measuring and proportioning air, gases, and liquids, are widely used throughout industry because of their ability to handle variable volumes over a wide range of pressures, with maintained accuracy. They are unusually free from operating attention or maintenance. Write for Bulletin.

ROOTS-CONNERSVILLE BLOWER CORP.
405 Ohio Avenue, Connersville, Indiana

Roots Connersville Since 1854

AIR • GAS • LIQUID Meters

PRICES

REFRACTORIES
(F.o.b. Works)

	Per 1000
Fire Clay Brick	
Super-duty brick, St. Louis	$64.60
First quality, Pa., Md., Ky., Mo., Ill.	51.30
First quality, New Jersey	56.00
Sec. quality, Pa., Md., Ky., Mo., Ill.	46.55
Second quality, New Jersey	51.00
No. 1, Ohio	43.00
Ground fire clay, net ton	7.60
Silica Brick	
Pennsylvania and Birmingham	$51.30
Chicago District	58.90
Silica cement, net ton (Eastern)	9.00
	Per Net Ton
Chrome Brick	
Standard chemically bonded, Balt., Plymouth Meeting, Chester	$54.00
Magnesite Brick	
Standard, Balt. and Chester	$76.00
Chemically bonded, Baltimore	65.00
Grain Magnesite	
Domestic, f.o.b. Balt. and Chester in sacks (carloads)	$43.48
Domestic, f.o.b. Chewelah, Wash. (in bulk)	22.00

RAILS, TRACK SUPPLIES
(F.o.b. Mill)

Standard rails, heavier than 60 lb., No. 1 O.H., gross ton	$40.00
Angle splice bars, 100 lb.	2.70
(F.o.b. Basing Points)	***Per Gross Ton***
Light rails (from billets)	$40.00
Light rails (from rail steel)	39.00
	Base per Lb.
Cut spikes	3.00c.
Screw spikes	5.15c.
Tie plates, steel	2.15c.
Tie plates, Pacific Coast	2.30c.
Track bolts	4.75c.
Track bolts, heat treated, to railroads	5.00c.
Track bolts, jobbers discount	63-5

Basing points, light rails, Pittsburgh, Chicago, Birmingham; cut spikes and tie plates—Pittsburgh, Chicago, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., Birmingham and Pacific Coast ports; tie plates alone—Steelton, Pa., Buffalo. Cut spikes alone—Youngstown, Lebanon, Pa., Richmond, Oregon and Washington ports, add 25c.

CORROSION AND HEAT-RESISTING STEEL
(Per lb. base price, f.o.b. Pittsburgh)

Chromium-Nickel Alloys

	No. 304	No. 302
Forging billets	21.25c.	20.40c.
Bars	25.00c.	24.00c.
Plates	29.00c.	27.00c.
Structural shapes	25.00c.	24.00c.
Sheets	36.00c.	34.00c.
Hot rolled strip	23.50c.	21.50c.
Cold rolled strip	30.00c.	28.00c.
Drawn wire	25.00c.	24.00c.

Straight-Chromium Alloys

	No. 410	No. 430	No. 442	No. 446
F.Billets	15.725c.	16.15c.	19.125c.	23.375c.
Bars	18.50c.	19.00c.	22.50c.	27.50c.
Plates	21.50c.	22.00c.	25.50c.	30.50c.
Sheets	26.50c.	29.00c.	32.50c.	36.50c.
Hot strip	17.00c.	17.50c.	24.00c.	35.00c.
Cold strip	22.00c.	22.50c.	32.00c.	52.00c.

Chromium-Nickel Clad Steel (20%)

	No. 304
Plates	18.00c.*
Sheets	19.00c.

*Includes annealing and pickling.

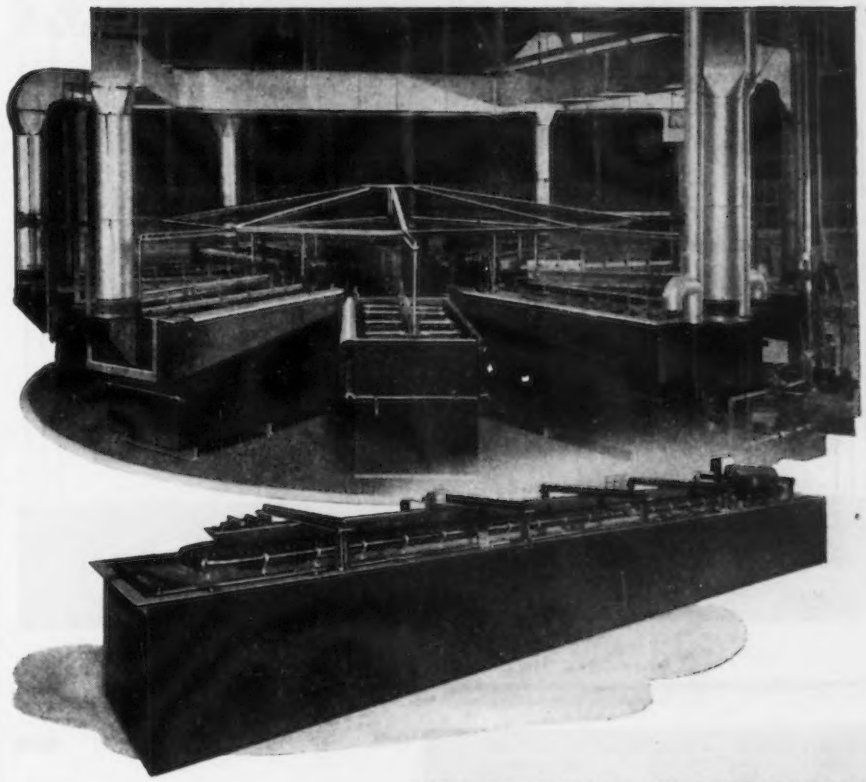
ELECTRICAL SHEETS
(Base, f.o.b. Pittsburgh)

	Per Lb.
Field grade	3.20c.
Armature	3.55c.
Electrical	4.05c.
Motor	4.95c.
Dynamo	5.65c.
Transformer 72	6.15c.
Transformer 65	7.15c.
Transformer 58	7.65c.
Transformer 52	8.45c.

F.o.b. Granite City, add 10c. per 100 lb. on field grade to and including dynamo. Pacific ports add 75c. per 100 lb. on all grades.

You can't beat this set-up for

FLEXIBILITY, CONTROL and ECONOMY in METAL FINISHING



UDYLITE'S AUTOMATIC ROTARY CONVEYOR with the UDYLITE SEMI-AUTOMATIC PLATING MACHINE

● If your metal finishing requirements call for exacting process and production control. If you could use the many advantages of a full automatic machine, at a fraction of the cost of such a machine, then you will want to investigate the above combination developed by Udylite's engineers.

The first cost of this set-up is amazingly economical. Their *flexibility* in converting from one use to another is new to the field. The clean and rinse cycle may be changed without altering plating time and one Udylite Automatic Rotary Conveyor, operating a clean and dry cycle, can serve a number of plating semi-automatics, each plating a different type of part.

It sounds too good to be true but it's a fact. We will be glad to discuss it with you.

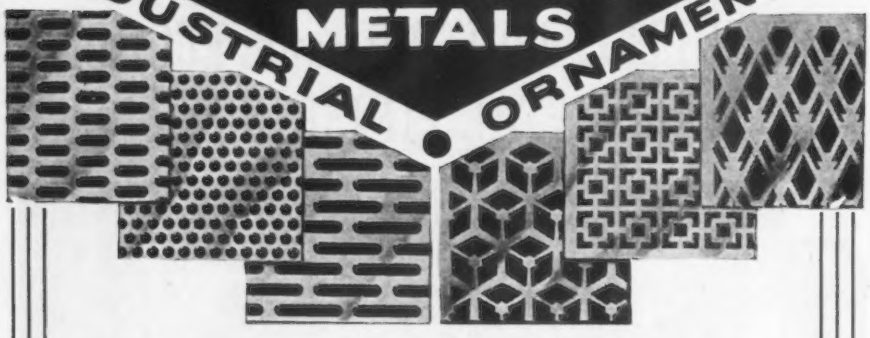
THE UDYLITE CORPORATION

1651 E. Grand Blvd., Detroit 11, Mich.

Chicago 12, 1943 Walnut Street
Long Island City 1, N. Y., 11-16 44th Drive
Cleveland 3, 4408 Carnegie Ave.

PERFORATED METALS

INDUSTRIAL • ORNAMENTAL



ANY METAL • ANY PERFORATION

Industrial—Well balanced screens of excellent material and workmanship to assure maximum screen production combined with durability.

Ornamental—Approved patterns and finishes including many exclusive and characteristic designs for grilles and furniture. We invite your inquiries.

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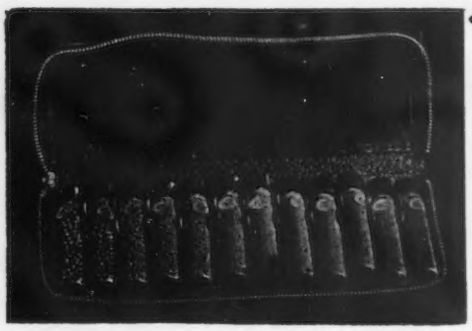

HEAT-TREATED STEEL SHOT

HEAT-TREATED STEEL GRIT

We manufacture shot and grit for endurance

A shot or grit that will blast fast with a clean finish.

This is the only reason why so many operators are daily changing to our shot and grit, from Maine to California.

The unprecedented demand for our—

Heat-Treated Steel Shot and Heat-Treated Steel Grit

has enabled us to expand our production and maintain a quality that is more than satisfactory to our hundreds of customers all over the country.

HARRISON ABRASIVE CORPORATION

Manchester, New Hampshire

PRICES

Ferromanganese

78-82% Mn, maximum contract base price per gross ton, lump size, f.o.b. car at Baltimore, Bethlehem, Philadelphia, New York, Birmingham, Rockdale, Rockwood, Tenn.

Carload lots (bulk)	$135.00
Carload lots (packed)	141.00
Less ton lots (packed)	148.50

Premium, $1.70 for each 1% above 82% Mn; penalty, $1.70 for each 1% below 78%.

Manganese Metal

Contract basis, lump size, per lb. of metal, f.o.b. shipping point with freight allowed. Spot sales add 2c. per lb.

96-98% Mn, .2% max. C, 1% max. Si, 2% max. Fe.

Carload, bulk	36c.
L.c.l. lots	38c.

95-97% Mn, .2% max. C, 1.5% max. Si, 2.5% max. Fe.

Carload, bulk	34c.
L.c.l. lots	35c.

Spiegeleisen

Maximum base, contract prices, per gross ton, lump, f.o.b. Palmerton, Pa.

	16-19% Mn 3% max. Si	19-21% Mn 3% max. Si
Carloads	$35.00	$36.00
Less ton	47.50	48.50

Electric Ferrosilicon

OPA maximum base price cents per lb. contained Si, lump size in carlots, f.o.b. shipping point with freight allowed to destination.

	Eastern Zone	Central Zone	Western Zone
50% Si	6.65c.	7.10c.	7.25c.
75% Si	8.05c.	8.20c.	8.75c.
80-90% Si	8.90c.	9.05c.	9.55c.
90-95% Si	11.05c.	11.20c.	11.65c.

Spot sales add: .45c. per lb. for 50% Si, .3c. per lb. or 75% Si .25c. per lb. for 80-90% and 90-95% Si.

Silvery Iron

(Per Gross Ton, base 6.00 to 6.50 Si)

F.o.b. Jackson, Ohio	$29.50*
Buffalo	30.75*

For each additional 0.50% silicon add $1 a ton. For each 0.50% manganese over 1% add 50c. a ton. Add $1 a ton for 0.75% phosphoros or over.

*OPA price established 6-24-41.

Bessemer Ferrosilicon

Prices are $1 a ton above silvery iron quotations of comparable analysis.

Silicon Metal

OPA maximum base price per lb. of contained Si, lump size, f.o.b. shipping point with freight allowed to destination, for l.c.l. above 2000 lb., packed. Add .25c. for spot sales.

	Eastern Zone	Central Zone	Western Zone
96% Si, 2% Fe.	13.10c.	13.55c.	16.50c.
97% Si, 1% Fe.	13.45c.	13.90c.	16.80c.

Ferrosilicon Briquets

OPA maximum base price per lb. of briquet, bulk, f.o.b. shipping point with freight allowed to destination. Approximately 40% Si. Add .25c. for spot sales.

	Eastern Zone	Central Zone	Western Zone
Carload, bulk	3.35c.	3.50c.	3.65c.
2000 lb.-carload	3.8c.	4.2c.	4.25c.

Silicomanganese

Contract basis lump size, per lb. of metal, f.o.b. shipping point with freight allowed. Add .25c. for spot sales. 65-70% Mn, 17-20% Si, 1.5% max. C.

Carload, bulk	6.05c.
2000 lb. to carload	6.70c.
Under 2000 lb.	6.90c.
Briquets, contract, basis carlots, bulk freight allowed, per lb.	5.80c.
2000 lb. to carload	6.30c.
Less ton lots	6.55c.

Ferrochrome

(65-72% Cr, 2% max. Si)

OPA maximum base contract prices per lb. of contained Cr, lump size in carload lots, f.o.b. shipping point, freight allowed to destination. Add .25c. per lb. contained Cr for spot sales.

	Eastern Zone	Central Zone	Western Zone
0.06% C	23.00c.	23.40c.	24.00c.
0.10% C	22.50c.	22.90c.	23.50c.
0.15% C	22.00c.	22.40c.	23.00c.
0.20% C	21.50c.	21.90c.	22.50c.
0.50% C	21.00c.	21.40c.	22.00c.
1.00% C	20.50c.	20.90c.	21.50c.
2.00% C	19.50c.	19.90c.	21.00c.
66-71% Cr, 4-10% C	13.00c.	13.40c.	14.00c.

PRICES

Other Ferroalloys

Ferrotungsten, Standard grade, lump or ¼X down, packed, f.o.b. plant at Niagara Falls, New York, Washington, Pa., York, Pa., per lb. contained tungsten, 10,000 lb. or more... $1.90

Ferrovanadium, 35-55%, contract basis, f.o.b. producer's plant, usual freight allowances, per usual freight allowances, per lb. contained Va.

Open Hearth	$2.70
Crucible	$2.80
Primos	$2.90

Cobalt, 97% min., keg packed, contract basis, f.o.b. producer's plant, usual freight allowances, per lb. of cobalt metal $1.50

Vanadium pentoxide, 88%-92% V_2O_5 technical grade, contract basis, any quantity, per lb. contained V_2O_5. Spot sales add 5c. per lb. contained V_2O_5 ..... $1.10

Ferroboron, contract basis, 17.50% min. Bo, f.o.b. producer's plant with usual freight allowances, per lb. of alloy.

2000 lb. to carload	$1.20
Under 2000 lb.	1.30

Silcaz No. 3, contract basis, f.o.b. producer's plant with usual freight allowances, per lb. of alloy. (Pending OPA approval)

Carload lots	25c.
2000 lb. to carload	26c.

Silvaz No. 3, contract basis, f.o.b. producer's plant with freight allowances, per lb. of alloy (Pending OPA approval)

Carload lots	58c.
2000 lb. to carload	59c.

Grainal, f.o.b. Bridgeville, Pa., freight allowed 50 lb. and over, max. based on rate to St. Louis

No. 1	87.5c.
No. 6	60c.
No. 79	45c.

Bortram, f.o.b. Niagara Falls

Ton lots, per lb.	45c.
Less ton lots, per lb.	50c.

Ferrocolumbium, 50-60%, contract basis, f.o.b. plant with freight allowances, per lb. contained Cb.

2000 lb. lots	$2.25
Under 2000 lb. lots	$2.30

Ferrotitanium, 40%-45%, f.o.b. 0.10c. max. Niagara Falls, N. Y., ton lots, per lb. contained Ti.. $1.23

Less ton lots $1.25

Ferrotitanium, 20%-25%, 0.10 C max., ton lots, per lb. contained titanium $1.35

Less ton lots $1.40

High-carbon ferrotitanium, 15%-20%, 6%-8% carbon, contract basis, f.o.b. Niagara Falls, N. Y., freight allowed East of Mississippi River, North of Baltimore and St. Louis, per carload $142.50

Ferrophosphorus, 18% electric or blast furnaces, f.o.b. Anniston, Ala., carlots with $3 unitage freight equaled with Rockdale, Tenn., per gross ton $58.50

Ferrophosphorus, electrolytic 23-26%, carlots, f.o.b. Monsanto (Siglo), Tenn., $3 unitage freight equalized with Nashville, per gross ton $75.00

Ferromolybdenum, 55-75%, f.o.b. Langeloth, Washington, Pa., any quantity, per lb. contained Mo. 95c.

Calcium molybdate, 40%-45%, f.o.b. Langeloth and Washington, Pa., any quantity, per lb. contained Mo ..... 80c.

Molybdenum oxide briquetes, 48%-52% Mo, f.o.b. Yangeloth, Pa., per lb. contained Mo ..... 80c.

Molybdenum oxide, in cans, f.o.b. Langeloth and Washington, Pa., per lb. contained Mo ..... 80c.

Zirconium, 35-40%, contract basis, f.o.b. producer's plant with freight allowances, per lb. of alloy. Add ¼c. for spot sales

Carload lots	14c.

Zirconium, 12-15%, contract basis, lump, f.o.b. plant usual freight allowances, per lb. of alloy

Carload, bulk	4.6c.

Alsifer (approx. 20% Al, 40% Si and 40% Fe), contract basis, f.o.b. Niagara Falls, carload, bulk ..... 5.75c.

Ton lots ..... 7.25c.

Simanal (approx. 20% Si, 20% Mn, 20% Al), contract basis, f.o.b. Philo, Ohio, with freight not to exceed St. Louis rate allowed, per lb.

Car lots	8.75c.
Ton lots	9.25c.

Did you Know?

Over 50% of furnace wall radiation losses alone can be stopped? **Therm-O-Flake** Insulation is preferred for this work in most steel plants.

Here's why!

Highest insulating value — easy to apply — low maintenance — low cost — high reclamation — sticks tightly to silica or basic brick — permits closer control of fuel-air ratios — reduces cold air infiltration.

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Illinois Clay Products Company
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HIGH TEMPERATURE INSULATION
BRICK - BLOCK - COATINGS - CONCRETE - GRANULES

GUN ADAPTER, for synchronizing machine guns and aerial camera . . . built by Brandt of high-tensile stainless steel . . . by stamping and welding processes . . . for use on Martin Marauders.

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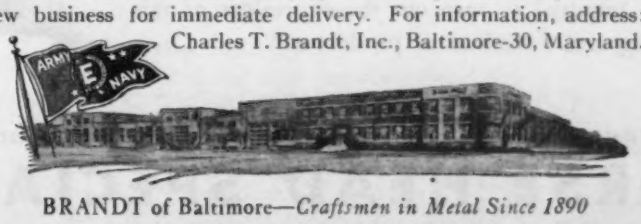
Call **BRANDT of Baltimore**

for Precision in Heavy Plate and Sheet Steel Work

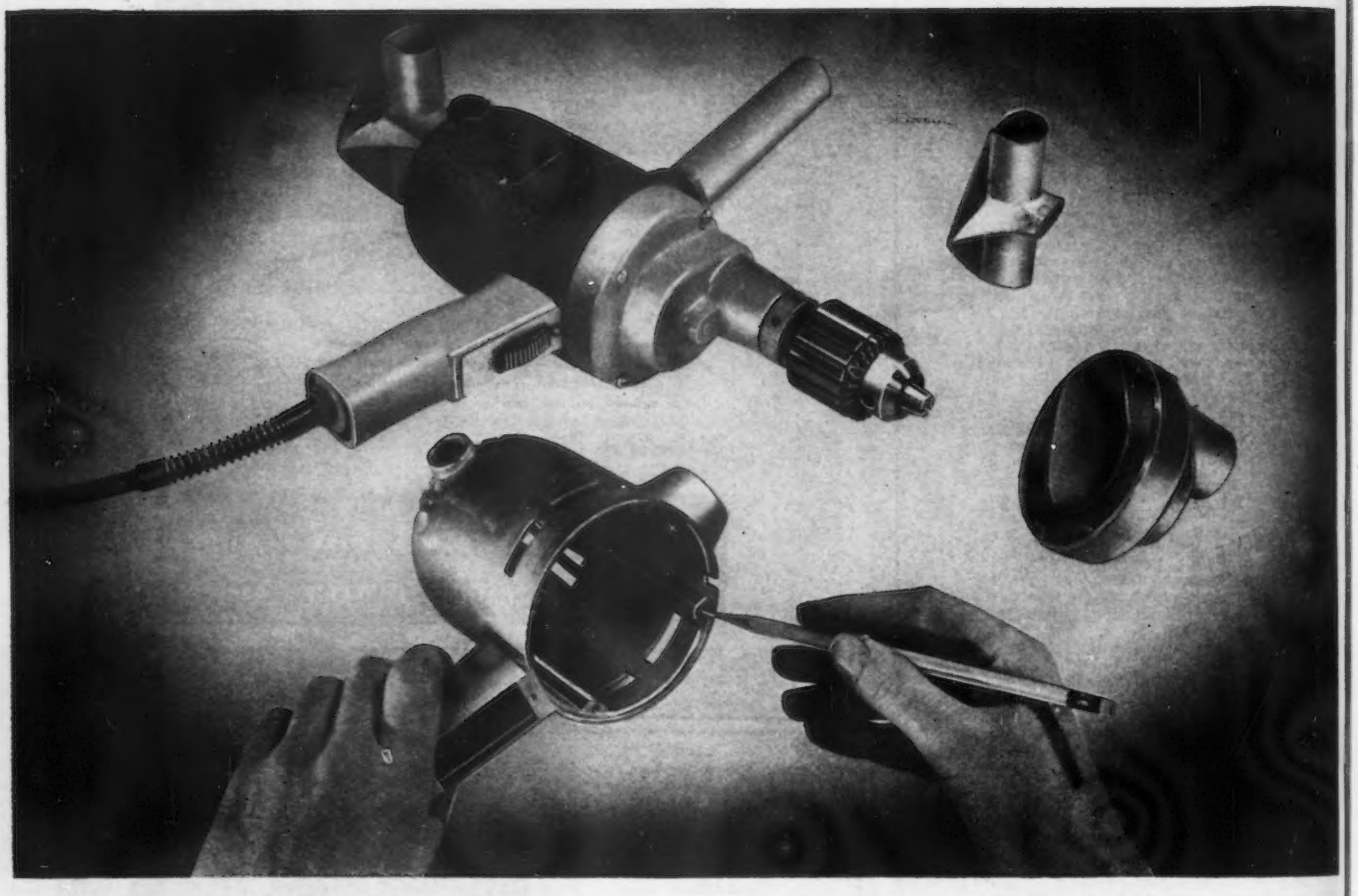
Here is an 8½ acre plant . . . with the most modern equipment for shearing, rolling, forming, welding and completely fabricating ferrous, non-ferrous and alloy metals to your specifications . . . from the lightest gauge up to and including 1¼" mild steel or ¾" armor plate. Extensive war contracts necessarily limit our present acceptance of new business for immediate delivery. For information, address: Charles T. Brandt, Inc., Baltimore-30, Maryland.



BRANDT of Baltimore—*Craftsmen in Metal Since 1890*

COMPLEXITY!

—59% LESS LABOR REQUIRED THRU THE USE OF 3 ZINC ALLOY DIE CASTINGS IN THIS DRILL



Zinc alloy die castings are solving many of today's labor shortage problems. For example, by redesigning this electric drill to utilize 3 zinc alloy die castings, a saving of 59% in machining labor was effected over the former material and method of manufacture. In dollars and cents, the overall cost of these 3 parts was reduced 46%—a major contribution in producing the lowest priced *quality* ½" electric drill now on the market.

Complexity of design presents the opportunity for these labor and cost savings. Consider, for instance, that the assembly elements are now integrally cast in the one-piece combined motor housing and handle (foreground). Imagine the number of operations which would be required to turn out the equivalent of this part by any other method of production!

Economy of production is only one of the reasons why die castings of zinc alloy are the most widely used under normal conditions. *Every die casting company is equipped to make zinc alloy die castings,* and will be glad to tell you about their many physical advantages—or write to The New Jersey Zinc Company, 160 Front Street, New York 7, New York.

ZINC
FOR DIE CASTING ALLOYS

The Research was done, the Alloys were developed, and most Die Castings are specified with
HORSE HEAD SPECIAL (99.99+% Uniform Quality) ZINC